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Monochaetum amistadense (Melastomataceae): A New Species from the Páramo of Costa Rica

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ABSTRACT. *Monochaetum amistadense*, a new species from the páramo of Costa Rica, is described, illustrated, and compared to its closest presumed relative, *M. compactum*. The distributional range of *M. trichophyllum* is extended from Panama to Costa Rica, and a diagnostic key is provided for the 10 species of *Monochaetum* now known from Costa Rica.

The evolution of morphologically distinct taxa, often of limited geographic extent, has been a recurrent theme in the evolution of *Monochaetum*, a montane neotropical genus of some 45–50 species. The most recent regional monograph attributed 18 species of *Monochaetum* to Mexico and Central America, eight of which were reported from Costa Rica (Almeda, 1978).

Collections of *Monochaetum* made in the Cordillera de Talamanca during the last decade have added two additional species to the Costa Rican flora. *Monochaetum trichophyllum* Almeda, which was described from and thought to be endemic to Panama, is now known from the Altantic slope of the Talamanca range (Limón: S side of unnamed cordillera between the Río Terbi and Río Siní, 2–4 airline km W of the Costa Rican–Panamanian border at 2,300–2,500 m, 11 Sep. 1984, *Davidse et al. 28946*, MO). The second addition, a distinctive novelty described below, is of special interest because it is the only known Costa Rican species confined to páramo habitats.

Monochaetum amistadense Almeda, sp. nov.

TYPE: Costa Rica. Limón: Cordillera de Talamanca, Cerro Kámuk massif, between Cerro Dudu and Cerro Apri, 9°14′30″–15′30″N, 83°03′30″–04′30″W, 23 and 26 Mar. 1984 (fl, fr), *Davidse et al. 25932* (holotype, CAS; isotypes, CR, MO). Figure 1.

Frutex 0.5–2 m altus; ramuli teretes sicut petioli inflorescentiaque dense pilis patulis barbellatis 0.5–1 mm longis induti. Petioli 0.5–1 mm longi; lamina 3–7.5 × 1.5–3 mm elliptica vel elliptico-ovata apice acuta basi obtusa vel rotundata, supra utrinsecus venas primarias densiuscule strigosa, subtus dense vel modice strigosa pilis 0.5–1 mm longis barbellatis, 3-nervata vel 3-plinervata. Inflorescentia terminalis 1–2 flora, flores 4-meri. Hypanthium (ad torum) 5–6 mm longum; calycis lobis 4.5–5.5 × 2–2.5 mm anguste oblongo-triangulares persistentes. Petala 10–12 × 5–7 mm obovata. Stamina dimorpha glabra, thecis subulatis, poro dorsaliter inclinato. Stamina maiora; thecae 7–8.5 mm longae; appendix dorsalis 3–3.5 × 0.5 mm, apice rotundato. Stamina minora: thecae 4.5–5 mm longae; appendix dorsalis 3 × 0.25 mm, apice hebeti-acuto. Ovarium 4-loculare apice modice setoso. Semina 0.5 mm longa, oblongo-arcuata.

Erect, rigidly branched shrub 0.5–2 m tall. Distal internodes terete, copiously covered with spreading barbellate hairs 0.5–1 mm long, the nodes beset with flexuous spreading distally barbellate hairs 1.5–2 mm long. Older branches glabrate with reddish brown exfoliating bark. Mature leaves equal to somewhat unequal in size in each pair; petioles 0.5–1 mm long and 0.5 mm wide; blades membranaceous, entire, 3–7.5 mm long, 1.5–3 mm wide, elliptic to elliptic-ovate, 3-nerved or 3-plinerved, the apex acute, the base obtuse to rounded, the margin entire; adaxial surface copiously beset with a strigose indument of barbellate multicellular hairs in 4 longitudinal belts between the impressed primary veins

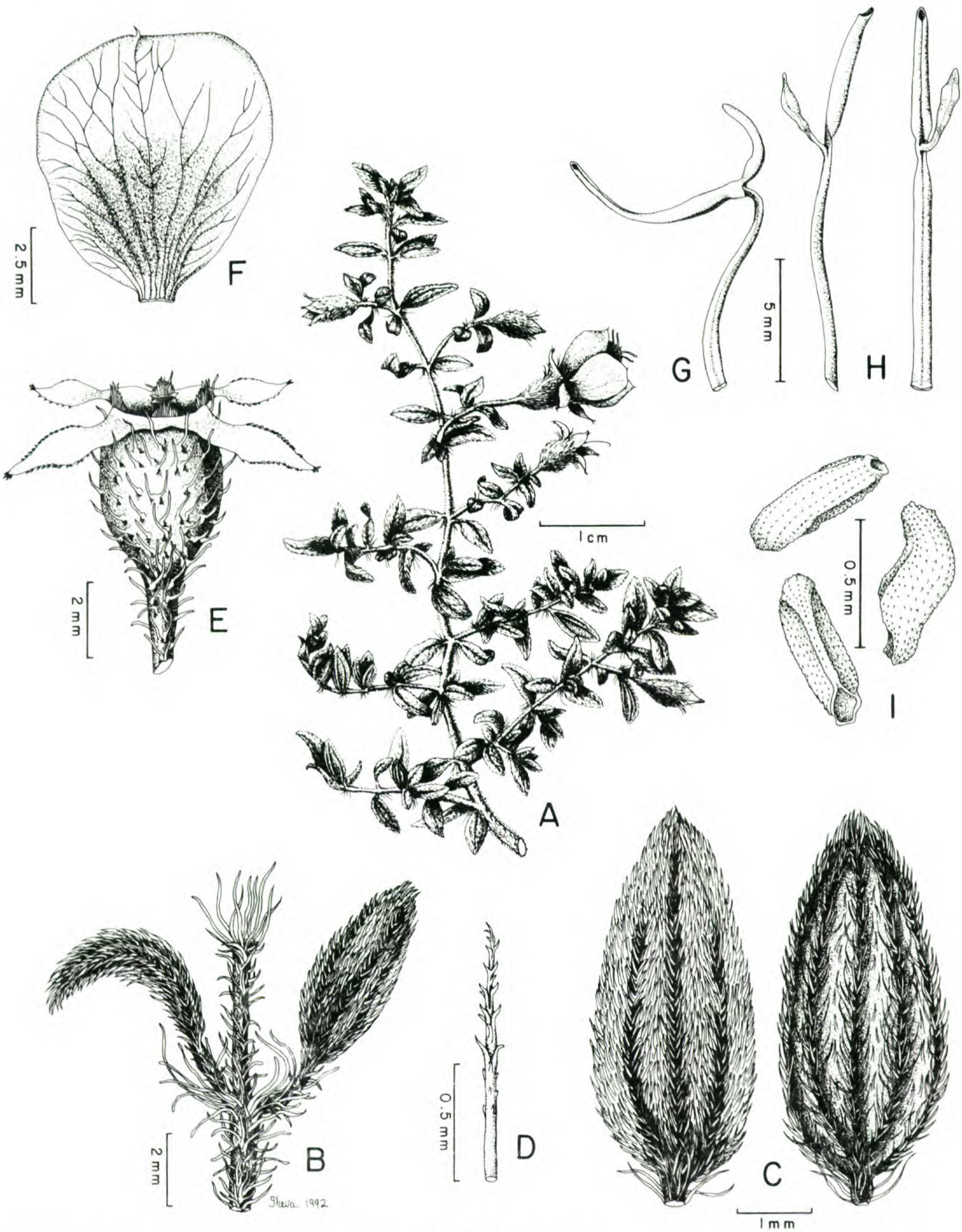

Figure 1. *Monochaetum amistadense* Almeda. —A. Habit. —B. Enlargement of cauline node and internode. —C. Representative leaves, adaxial surface (left) and abaxial surface (right). —D. Enlargement of adaxial foliar hair. —E. Fruiting hypanthium. —F. Petal. —G. Antepetalous stamen in profile view. —H. Antesepalous stamen, profile view (left), dorsal view (right). —I. Seeds. (A from *Davidse et al. 29023*, CAS; B–I from the holotype.)

that essentially conceal the blade surface; abaxial surface also copiously beset with a strigose indument of barbellate multicellular hairs largely concentrated on but not restricted to the three elevated primary veins. Inflorescence reduced to solitary or paired 4-merous flowers commonly terminating lateral floriferous shoots; bracteoles only slightly reduced in size, otherwise identical to principal leaves in all

respects; pedicels (at anthesis) 2–9 mm long lengthening up to 1.3 cm in fruit, moderately beset with appressed to antrorsely spreading barbellate hairs to 1 mm long. Fruiting hypanthia 5–6 mm long to the torus, 4 mm wide, campanulate to subcylindric, deeply pigmented and moderately covered with antrorsely spreading hairs like those of the pedicels. Calyx lobes (in fruit) persistent, 4.5–5.5 mm long and 2–2.5 mm wide at the base, narrowly triangular, adaxial surface glabrous, abaxial surface glabrous or beset with a few scattered barbellate hairs, the margins entire but fringed with barbellate hairs. Petals 10–12 × 5–7 mm, magenta, obovate, glabrous or with 1–3 hairs apically. Stamens strongly dimorphic, with dorsally inclined apical pores; larger (antepetalous) stamens geniculate, filaments 7–8 mm long, anther thecae 7–8.5 mm long, subulate, connective modified at the filament insertion into an incurved, dorso-basal, linear-oblong appendage 3–3.5 mm long; smaller (antesepalous) stamens ± erect, filaments 7–9 mm long, anther thecae 4.5–5 mm long, linear-oblong to subulate; connective modified at the filament insertion into an upturned, dorso-basal narrowly elliptic-lanceolate appendage 3 mm long. Ovary (at anthesis) superior, ovoid to obovoid, the body essentially glabrous but copiously setose at the summit surrounding the stylar scar. Style 6–7 mm long, somewhat declined to one side of the flower opposing the larger stamens. Capsules dry, semiwoody, loculicidal, erect at maturity and enclosed by the enveloping hypanthium; seeds 0.5 mm long, oblong-arcuate, somewhat keeled on the concave side, light brown and essentially smooth with a subdued luster.

Distribution. Known only from páramo habitats dominated by *Blechnum*, *Diplostephium*, and other shrubs in the southern Cordillera de Talamanca from Cerro Dúrika to an unnamed cordillera just southeast of the Cerro Kámuk massif between the Río Siní and the Río Terbi west of the Panamanian frontier at elevations of 2,400–3,280 m. The range of *M. amistadense* is contained within the Costa Rican sector of Parque Internacional La Amistad.

Monochaetum amistadense, one of six endemic species in Costa Rica, is characterized by unusually small leaf blades that are 3-nerved or 3-plinerved, inflorescences reduced to solitary or paired flowers, and oblong-arcuate seeds that are somewhat keeled on the concave side and not strongly coiled distally. It is most similar to and may be derived from *M. compactum* Almeda of western Panama: the two have similar habits, stem pubescence, leaf shape, and petal color. *Monochaetum compactum*, however, has modally larger (to 2.8 cm long), 5-plinerved leaf blades, a mixture of glandular and barbellate hypanthial and pedicellar hairs, an inflorescence consisting of compound dichasia with flowers subtended by reduced bracteoles, and cochleate seeds that are coiled distally and lack a keel on the concave side.

Paratypes. COSTA RICA. LIMON: Cordillera de Talamanca, Atlantic slope, unnamed cordillera between Río Siní and Río Terbi, 9°00′–9°12′N, 82°58′–82°59′W, 13 Sep. 1984 (fl), *Davidse et al. 29023* (CAS, CR, MO). PUNTARENAS: Cantón de Buenos Aires, Ujarrás, El Carmen, Cerro Dúrika, 9°22′35″N, 83°18′24″W, 12 Oct. 1989 (fl, fr), *A. Chacón 521* (CAS, CR, INBIO, MO).

Morphologically, *M. amistadense* does not appear to be particularly close to any of the Costa Rican members of the genus and is readily distinguished from them by the following key.

KEY TO THE SPECIES OF *MONOCHAETUM* IN COSTA RICA

1a. Distal internode pubescence consisting of widely to retrorsely spreading barbellate hairs.
2a. Sprawling or trailing subshrubs, the lateral branchlets divaricate and held at an angle of 65°–90°; adaxial foliar pubescence not forming well-defined longitudinal belts between the impressed primary veins; seeds dark brown, glossy, semicircular and laterally compressed; petals pink; Costa Rica and Panama ..... *M. trichophyllum* Almeda
2b. Erect, laxly to compactly branched shrubs, the lateral branchlets held at an angle of 45° or less; adaxial foliar pubescence forming 4 to 6 well-defined longitudinal belts between the impressed primary veins; seeds orange-brown with a subdued luster, cochleate or oblong-arcuate; petals white or magenta.
3a. Principal leaves lanceolate to elliptic-lanceolate, 1.4–8.0 cm long, 0.6–2.9 cm wide, petioles 1–5(–11) mm long; cauline hairs 1–3(–5) mm long; inflorescence a multiflowered dichasial cyme with flowers subtended by sessile bracteoles that differ from principal leaves in size and shape; petals white; seeds distinctly cochleate and strongly coiled at the distal end; Mexico to Panama ..... *M. floribundum* (Schlechtendal) Naudin
3b. Principal leaves elliptic to elliptic-ovate, 3–7.5 mm long, 1.5–3 mm wide, petioles 0.5–1 mm long; cauline hairs 0.5–1 mm long; inflorescence reduced to solitary or paired flowers subtended by petiolate bracteoles that are similar to principal leaves in size and shape; petals magenta; seeds oblong-arcuate, not strongly coiled at the distal end; endemic to Costa Rica ..... *M. amistadense* Almeda

1b. Distal internode pubescence consisting of appressed, barbellate or smooth hairs, or internodes entirely glabrous.
4a. Sprawling or trailing subshrubs, the lateral branchlets divaricate and held at an angle of 65°–90°; seeds dark brown and glossy, somewhat semicircular, laterally compressed and without pronounced gyrations.
5a. Hypanthial hairs appressed, essentially smooth and eglandular; calyx lobes 6–10 mm long, antrorsely spreading on fruiting hypanthia; principal leaves 3(–5)-plinerved with appressed hairs on and closely adjacent to the elevated primary veins abaxially; petals 15–19 mm long; white when fresh but drying to shades of pink; endemic to Costa Rica ..... *M. talamancense* Almeda
5b. Hypanthial hairs antrorsely to widely spreading, smooth and often partly gland-tipped, calyx lobes 4–6 mm long, widely spreading to reflexed on fruiting hypanthia; principal leaves 5–7-plinerved (infrequently 3-plinerved) with appressed to antrorsely spreading hairs on the abaxial elevated primary veins and pilosulous to glabrate between them; petals 10–14 mm long, pink when fresh but often drying lavender or intense purple; Costa Rica and Panama ..... *M. neglectum* Almeda
4b. Erect, laxly to compactly branched shrubs, the lateral branchlets held at an angle of 45° or less; seeds orange-brown with a subdued luster, cochleate, laterally gyrate, and strongly coiled at the distal end.
6a. Distal internodes glabrous; principal leaves sessile, cordate and clasping with 7–9(–11) elevated primary veins abaxially; hypanthia mostly glabrous except for a few barbellate hairs along the torus at the abaxial base of the calyx lobes; Costa Rica and Panama ..... *M. cordatum* Almeda
6b. Distal internodes sparsely to copiously covered with appressed, barbellate hairs; principal leaves petiolate, varying in shape but never cordate or sessile; hypanthia covered with appressed, barbellate hairs occasionally intermixed with smooth, spreading glandular hairs.
7a. Principal leaves linear-oblong, 1.5–4 mm wide, 1(–3)-nerved with only the median vein elevated abaxially and extending the entire length of the blade; endemic to Costa Rica ..... *M. linearifolium* Almeda
7b. Principal leaves narrowly elliptic, elliptic-ovate, elliptic-lanceolate, ovate, or obovate, (2–)4–16(–20) mm wide, 3–5(–7)-plinerved with at least three veins elevated abaxially, the innermost pair of primary veins diverging from the median vein at a point well above the petiole–laminar junction.
8a. Bracteoles sessile, narrowly lance-triangular to subulate, commonly navicular and enveloping floral buds or their pedicels; petals white or pink; endemic to Costa Rica ..... *M. macrantherum* Gleason
8b. Bracteoles distinctly petiolate or tapering basally into a compressed, ill-defined petiolar region, elliptic, elliptic-lanceolate, linear-oblong, oblanceolate, or spatulate but never enveloping floral buds or their pedicels; petals magenta.
9a. Distal internodes quadrangular and strongly carinate at the intersection of adjacent stem faces; principal leaves ovate, elliptic-ovate, or varying to obovate, glabrous adaxially or with pubescence restricted to narrow belts along the distal half or third of the blade; calyx lobes lance-triangular and acute apically; endemic to Costa Rica ..... *M. vulcanicum* Cogniaux
9b. Distal internodes terete to subterete; principal leaves narrowly elliptic to elliptic-lanceolate with 4 well-defined adaxial belts of pubescence between the impressed primary veins extending the entire length of the blade; calyx lobes linear-oblong to bluntly deltoid, rounded to obtuse apically; endemic to Costa Rica ..... *M. amabile* Almeda

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Literature Cited

Almeda, F. 1978. Systematics of the genus *Monochaetum* (Melastomataceae) in Mexico and Central America. Univ. Calif. Publ. Bot. 75: 1–134.

New Species of *Miconia* (Melastomataceae) from Costa Rica

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ABSTRACT. Two new Costa Rican species of *Miconia*, *M. friedmaniorum* and *M. pendula*, are described and compared with their probable relatives. Discussions, distributional notes, and diagnostic illustrations are provided for each species.

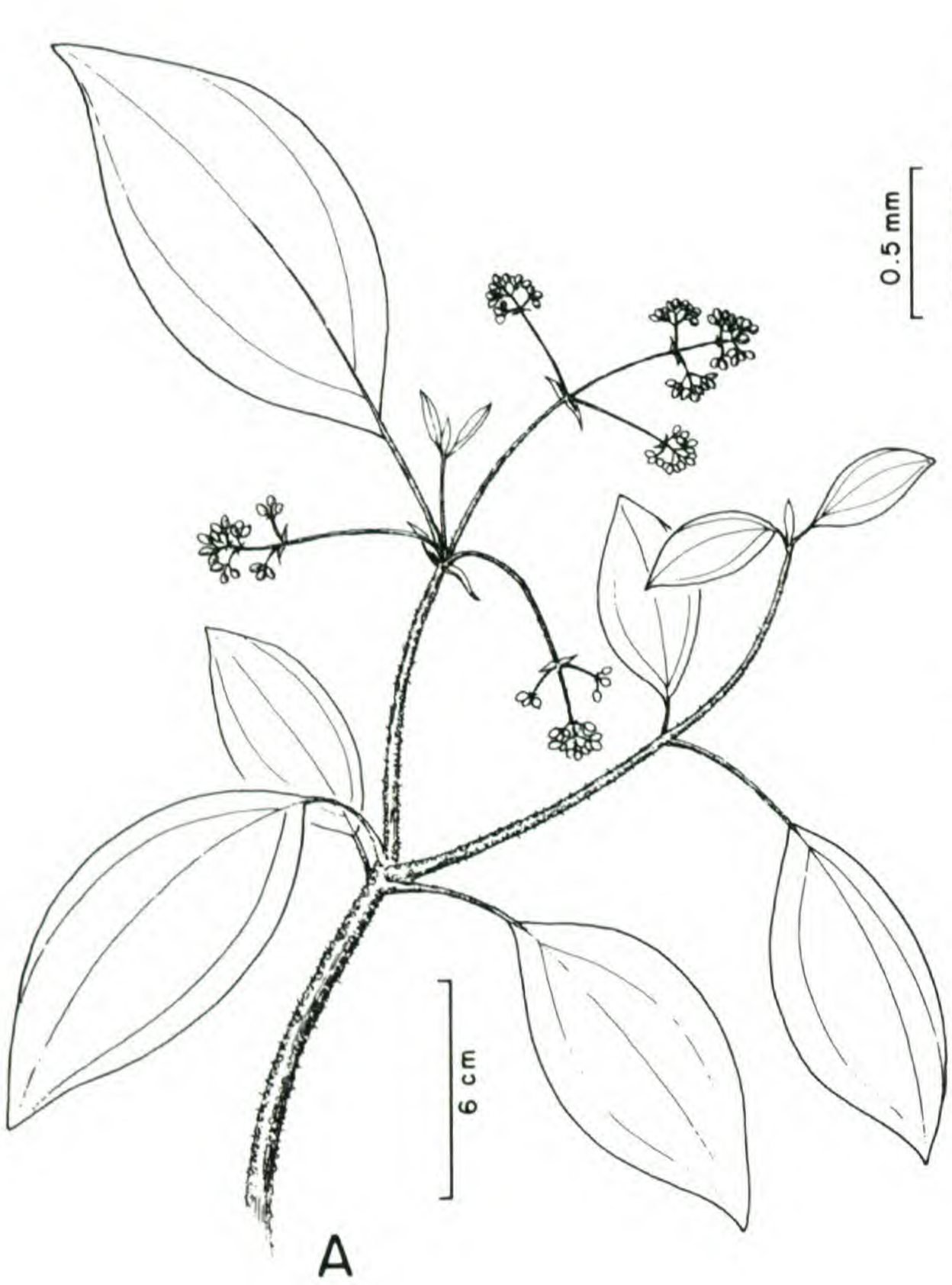
Collecting activity in the mid-elevation montane forests of Costa Rica continues to yield new and unusual species of *Miconia*. Of the approximately 98 taxa of *Miconia* known from Costa Rica, 12 now appear to be endemic to the country.

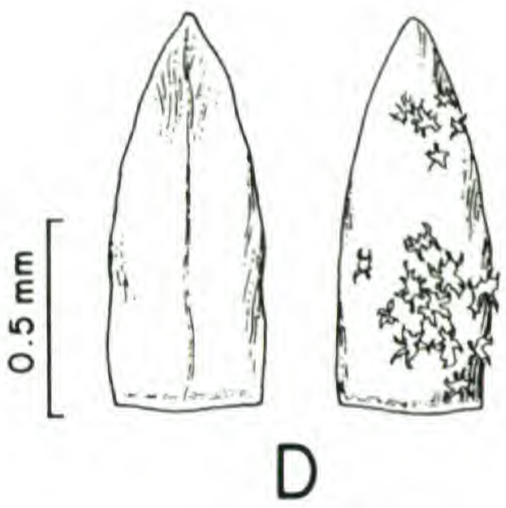
Shared floral and fruit characters suggest that the two species proposed here are closely related. Both taxa occur in wet primary forests and have similar elevational distributions, but they appear to be allopatric. *Miconia friedmaniorum* is known from the Cordillera de Tilarán and the Cordillera de Guanacaste, whereas *M. pendula* has been collected at one site in the Tapantí National Wildlife Refuge and Braulio Carrillo National Park.

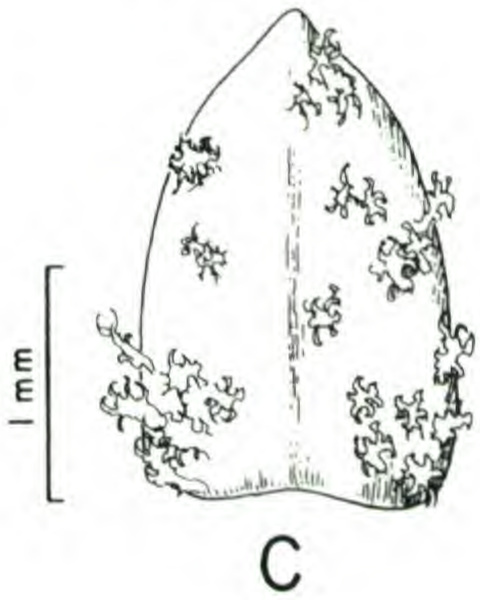
Miconia friedmaniorum Almeda & Umaña, sp. nov. TYPE: Costa Rica. Alajuela: Upala, Colonia Libertad, subiendo hasta el Llano Aguacatales, 1,500 m, 10°48′25″N, 85°17′50″W, 28 Apr. 1988 (fl), *Herrera 1900* (holotype, CR; isotypes, CAS, F, MEXU, MO, PMA, USJ). Figure 1.

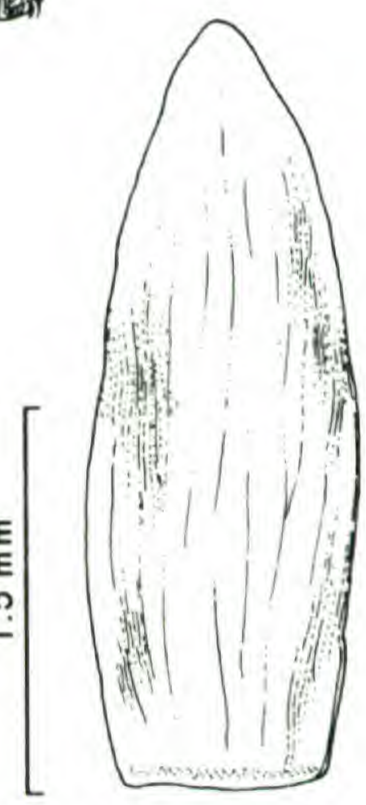
Arbor 2–5 m. Ramuli quadrangulati demum teretes sicut petioli foliorum subtus venae primariae inflorescentia hypanthiaque pilis asperis 0.25–0.5 mm longis erectis dense induti demum glabrati. Lamina 10.1–14.4 × 5.5–7.2 cm elliptica vel elliptico-ovata apice acuminata basi obtusa vel asymmetrice rotundato-obtusa, supra glabra, subtus in venis secundariis tertiariisque pilis asperis vel sparse caduceque granuloso-furfuracea, 5-plinervata, membranacea. Inflorescentia 5–6 cm longa multiflora; flores 5-meri, pedicellis (ad anthesim) 1–1.6 mm longis, bracteolis 0.5–1.5 × 0.5 mm persistentibus. Hypanthium (ad torum) 1.5–2 mm longum; calyx primum in cono clausus demum in lobos regulares persistentes ruptus, dentibus exterioribus 0.5–0.6 mm eminentibus. Petala 2.5–3 × 0.9–1 mm oblongo-elliptica glabra. Stamina isomorphica glabra; antherarum thecae 1.2–1.5 × 0.3–0.5 mm angustae oblongae, poro dorsaliter inclinato; connectivum nec prolongatum nec appendiculatum. Stylus 5 mm glaber; ovarium 5-loculare et ¾ inferum apice sparsiuscule glanduloso-puberulo.

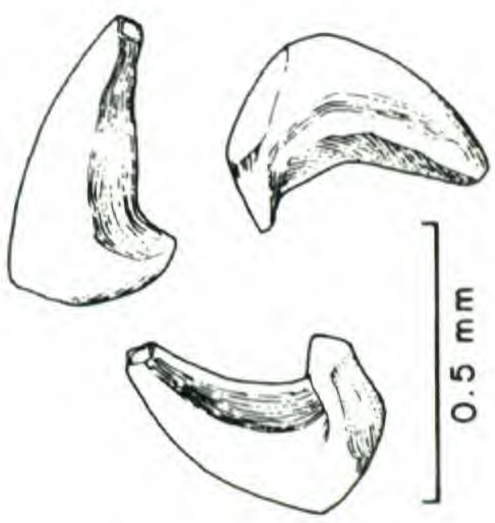
Tree 2–5 m tall, young branchlets, distal petioles, elevated primaries on the abaxial foliar surfaces, and hypanthia densely covered with inconspicuously stalked asperous-headed multicellular hairs but glabrate with age, the distal nodes sparingly beset with spreading simple multicellular hairs. Older branches somewhat quadrate to rounded with age, the nodes inconspicuously beset with interpetiolar lines or ridges. Mature leaves membranaceous, entire but varying to inconspicuously denticulate, 10.1–14.4 cm long, 5.5–7.2 cm wide, elliptic to elliptic-ovate, acuminate apically, obtuse to conspicuously oblique basally, glabrous adaxially, moderately to sparsely covered with a mixture of inconspicuously asperous-headed and scalelike multicellular hairs on the secondary and higher order veins abaxially, 5-plinerved with uppermost primaries mostly diverging from the median nerve in alternate or subalternate fashion, the secondaries conspicuous abaxially and mostly 3–6.5 mm apart; petioles 2.1–4.8 cm long, 1–1.5 mm wide. Inflorescence an erect modified cyme 5–6 cm long, commonly branched from the base, bracts of the rachis nodes paired, linear-oblong to narrowly triangular, 1.5–4 mm long, 1 mm wide, with pubescence like that of the distal branchlets, bracteoles sessile, persistent, triangular, 0.5–1.5 mm long, 0.5 mm wide, glabrous. Pedicels 1–1.6 mm long. Hypanthia (at anthesis) campanulate, 1.5–2 mm long to the torus (vascular ring). Calyx fused into a dome in young buds but rupturing at anthesis into 4 or 5 persistent broadly rounded hyaline lobes mostly 0.5–1.5 mm long and 0.5–1.1 mm wide basally; exterior calyx teeth 5, narrowly triangular, 0.5–0.6 mm long, typically exceeding the lobes, torus glabrous and undulately lobed abaxially. Petals 5, glabrous, pale pink, linear-oblong, obtuse to rounded but often

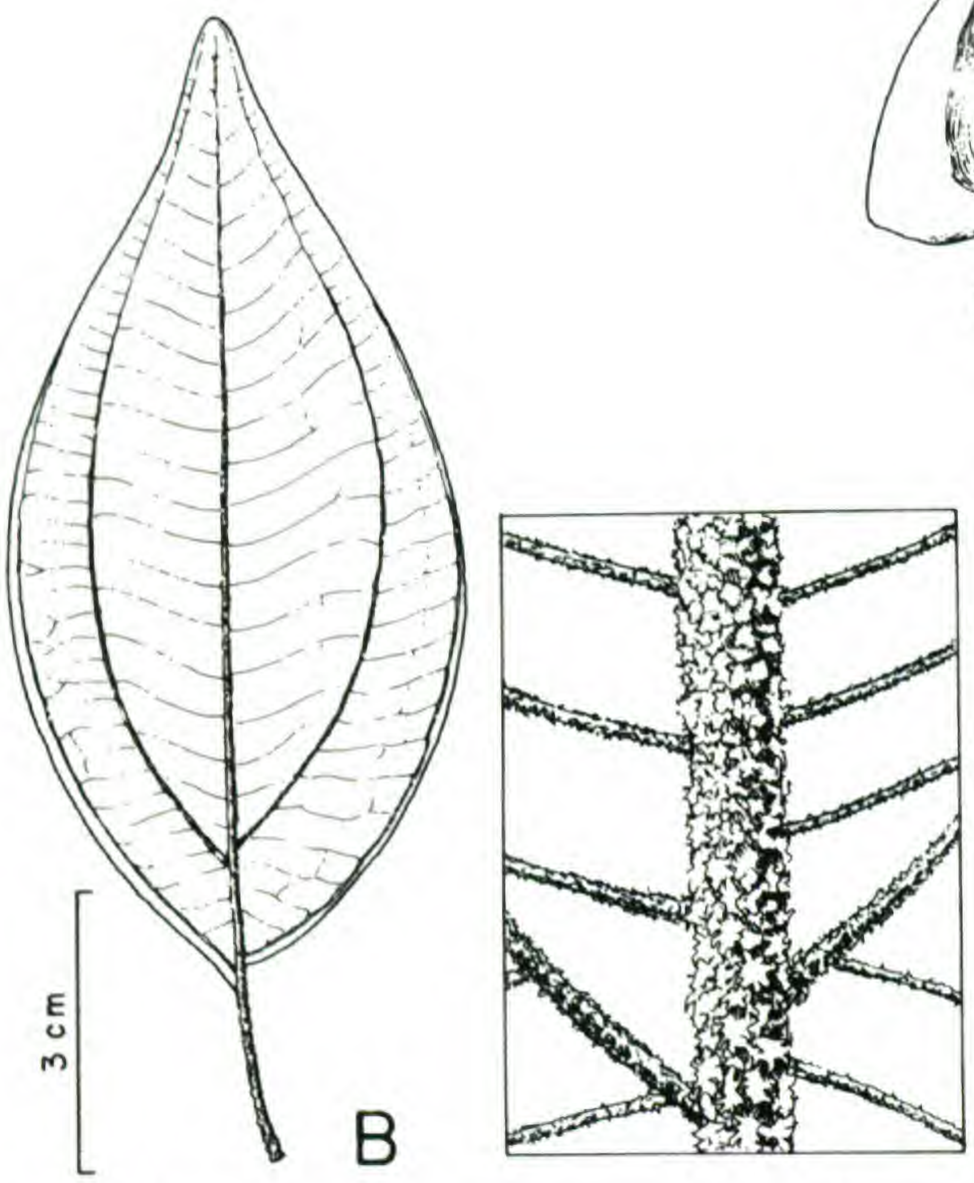












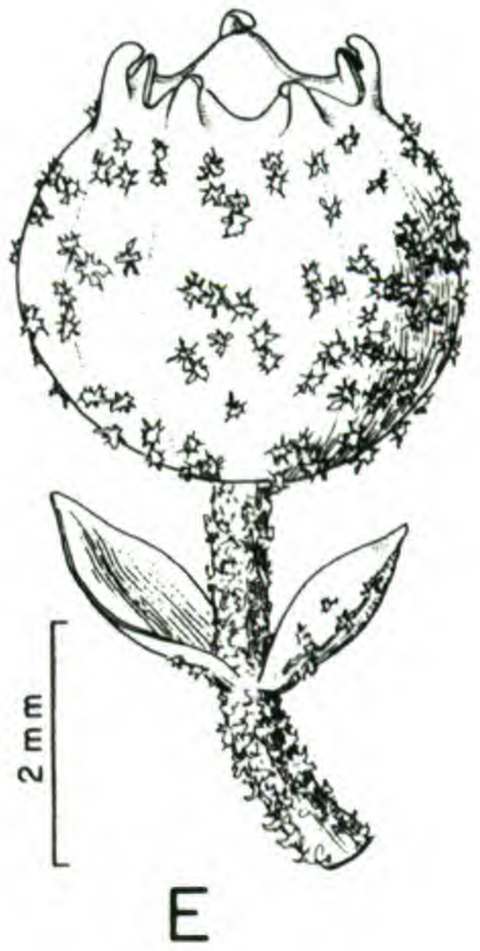


Figure 1. *Miconia friedmaniorum* Almeda & Umaña. —A. Habit. —B. Representative leaf, abaxial surface (left) and enlargement of median vein (right). —C. Floral bract (abaxial surface). —D. Bracteoles, adaxial surface (left) and abaxial surface (right). —E. Berry. —F. Petal. —G. Stamens, ventral view (left) and profile view (right). —H. Seeds. (A–G from *Almeda & Anderson 5416*; H from *Herrera 1465*.)

somewhat cucullate and superficially appearing subacute apically when dry, 2.5–3 mm long, 0.9–1 mm wide. Stamens 10, isomorphic, filaments complanate, glabrous, constricted and incurved distally, 0.8–1 mm long, 0.25–0.3 mm wide; anthers 1.2–1.5 mm long, 0.3–0.5 mm wide, yellow, linear-oblong but laterally compressed and ovate-oblong in profile view, somewhat truncate with a dorsally inclined pore; connective thickened dorsally but not prolonged or appendaged at the filament insertion. Ovary (at anthesis) ¾ inferior, 5-celled, globose, apex gently fluted, sparingly beset with glandular hairs but lacking a stylar collar. Style somewhat curved distally, glabrous, 5 mm long, 0.6 mm wide; stigma truncate and somewhat dilated. Berry globose, red turning purple when mature, 3–3.5 mm long and 3–3.5 mm diam. Seeds angular-pyramidate to somewhat crescent-shaped in profile view, beige, ca. 0.5 mm long, smooth.

Distribution. Known from the Monteverde Cloud Forest Reserve (Cordillera de Tilarán), the adjacent San Ramón Forest Reserve, and Parque Nacional Rincón de la Vieja (Cordillera de Guanacaste) in northwestern Costa Rica, where it commonly occurs in cloud forests with an Atlantic slope exposure at elevations of (900–)1,350–1,700 m.

Miconia friedmaniorum is notable for its brown pubescence, which consists of asperous-headed hairs that commonly obscure the surfaces of young branchlets, elevated primary veins on abaxial foliar surfaces and young hypanthia. These asperous-headed hairs most closely approach the dendritic hairs with short thin-walled (flattened) arms illustrated by Wurdack (1986: 64). This indument together with the basally branched cymose inflorescence, pink, linear-oblong petals, and 5-plinerved leaves with uppermost primaries diverging from the median vein in alternate fashion provide a diagnostic suite of characters distinguishing *M. friedmaniorum* from its congeners.

In overall aspect, *M. friedmaniorum* is most reminiscent of *M. pendula* (also described herein). We interpreted the first fragmentary collection of the latter taxon as a conspecific variant of *M. friedmaniorum*. However, subsequent field study and the collection of good flowering and fruiting material indicate that *M. pendula* is distinctive and worthy of specific status. *Miconia friedmaniorum* resembles *M. pendula* in foliar shape and venation and in the details of petal, staminal, and seed morphology. Both species also share an inconspicuous calyx dome that ruptures into rounded hyaline lobes that are largely concealed by the prominent exterior calyx teeth. *Miconia pendula* differs consistently in several important characters. It has a complex lanate (not asperous) indument on young branchlets, petioles, inflorescence branches, and hypanthia, a mostly pendent modified cyme branched well above the node initiating the inflorescence, and bracts and bracteoles that are pustulate abaxially and invested basally with hairs that are often bifid or irregularly barbed at the apex. Unfortunately, the pustulate nature of the bracts and bracteoles is often distorted by pressing and drying and not always readily observed in herbarium material.

This species is named in honor of Nathan Jay and Virginia Friedman, long-time members of the California Academy of Sciences, in recognition of their exemplary interest and support of botanical exploration and conservation in Costa Rica.

Paratypes. COSTA RICA. ALAJUELA: Monteverde Reserve, Cerro Negro, continental divide, 10°20′N, 84°50′W, 12 Sep. 1985 (fr), *Bello 3242* (CAS, CR, MO); Reserva Forestal de San Ramón, camino de entrada cerca de la estación, 10°13′N, 84°37′W, 6 July 1992 (fl), *Gómez-Laurito 12073* (CR, USJ). ALAJUELA–PUNTARENAS BORDER: Cordillera de Tilarán, Monteverde Reserve, Sendero Brillante along continental divide, 25 Feb. 1992 (fr), *Almeda & Daniel 7074* (CAS, CR). ALAJUELA–GUANACASTE–PUNTARENAS BORDER: Cordillera de Tilarán, Monteverde Reserve, Sendero El Valle, 7 Mar. 1986 (fl), *Almeda & Anderson 5416* (CAS, CR, MO, NY, US); Reserve Monteverde, vertiente Pacífico cerca de división continental (ventana), 31 July 1976 (fr), *Dryer 535* (CR); Reserva Monteverde, vertiente Atlántico, Sendero El Valle, Dec. 1977 (fr), *Dryer 1718* (CR). GUANACASTE: Parque Nacional Rincón de la Vieja, Cabeceras de Quebrada Provisión y Quebrada Rancho Grande, Meseta Aguacatales, 10°46′N, 85°49′W, 1 Dec. 1987 (fr), *Herrera 1465* (CAS, CR, MO).

Miconia pendula Umaña & Almeda, sp. nov. TYPE: Costa Rica. Cartago: Refugio Nacional de Vida Silvestre Tapantí, orilla de Sendero Los Palmitos, 1,300–1,400 m, 09°44′00″N, 83°47′00″W, 2 Aug. 1990 (fl), *Umaña et al. 391* (holotype, CR; isotypes, BM, BR, CAS, COL, CR, F, MEXU, MO, NY, PMA, US, USJ). Figure 2.

Frutex 4 m. Ramuli sicut petioli foliorum subtus venae primariae inflorescentia hypanthiaque dense setosi pilis 1–3 mm longis et modice pilis amorpho-pinoideis ca. 0.1–0.25 mm longis puberuli. Lamina 10.1–20.3 × 6.4–12.4 cm elliptica vel elliptico-ovata apice acuminata basi obtusa vel asymmetrice rotundato-obtusa, supra sparse strigosa vel glabrata, subtus in venis secundariis tertiariisque sparse caduceque granuloso-furfuracea, 7-plinervata, membranacea. Inflorescentia 7–11.2 cm longa (pedunculo 0.5–4.7 cm arcuato incluso) multiflora; flores 5(–6)-meri, pedicellis (ad anthesim) 0.5–2.5 mm longis, bracteolis 0.2–0.3 × 0.1–0.2 cm persistentibus. Hypanthium (ad torum) 2–3 mm longum; calyx primum in cono clausus demum in lobos regulares persistentes ruptus, dentibus exterioribus 0.9–1.3 mm eminentibus. Petala 2.5–4 ×

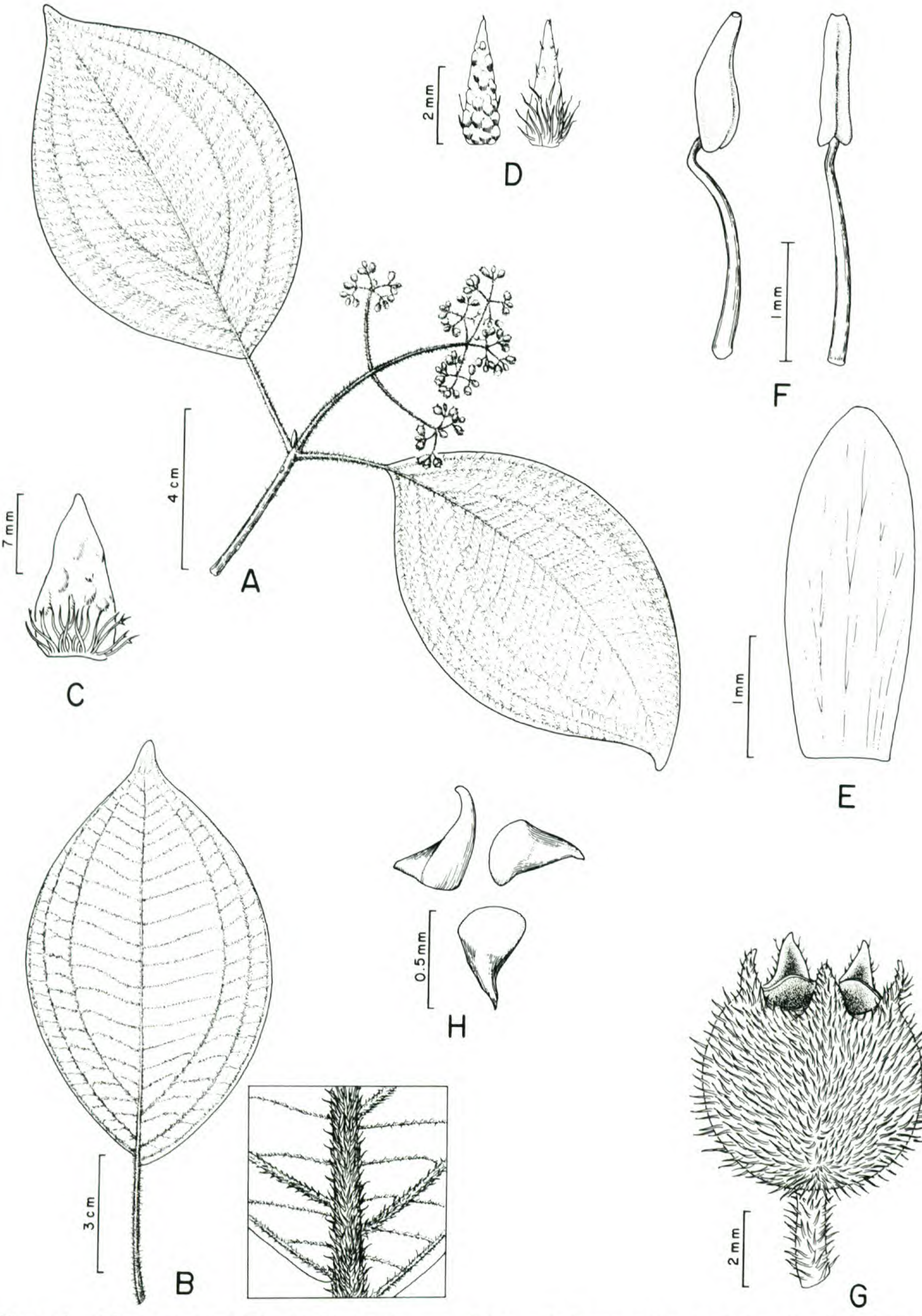


Figure 2. *Miconia pendula* Umaña & Almeda. —A. Habit. —B. Representative leaf, abaxial surface (left) and enlargement of median vein (right). —C. Floral bract (adaxial surface). —D. Bracteoles, abaxial surface (left) and adaxial surface (right). —E. Petal. —F. Stamens, lateral view (left) and ventral view (right). —G. Berry. —H. Seeds. (A–F from *Umaña et al. 391*; G, H from *Croat & Grayum 68255*.)

1 mm oblongo-elliptica glabra. Stamina isomorphica glabra; antherarum thecae 1.1–1.5 × 0.4–0.5 mm anguste oblongae, poro paulo dorsaliter inclinato; connectivum nec prolongatum nec appendiculatum. Stylus 2.5–5 mm glaber; ovarium 5-loculare et ⅔ inferum apice sparsiuscule glanduloso-puberulo.

Laxly branched shrub to 4 m tall, young branchlets, petioles of young leaves, and inflorescence rachis moderately to densely covered with a lanate indument of curly or sinuate barbellate or distally bifid multicellular hairs mostly 1–3 mm long that are intermixed with and seemingly grade into a ground layer of shorter amorpho-pinoid multicellular hairs. Older branches somewhat quadrate to rounded with age, bearing conspicuous interpetiolar lines or ridges. Mature leaves membranaceous, inconspicuously denticulate to subentire, 10.1–20.3 cm long, 6.4–12.4 cm wide, elliptic to elliptic-ovate, acuminate apically, obtuse to conspicuously oblique basally, sparingly strigose to glabrous adaxially, lanate on the elevated primaries abaxially and diminutively furfuraceous on prominulous secondary and higher order veins, 7-plinerved with the uppermost primaries typically diverging from the median nerve in alternate or subalternate fashion, the secondaries conspicuous abaxially and mostly 4–8 mm apart; petioles 1.5–9 cm long, 1–2 mm wide. Inflorescence an arcuate or pendent, modified cyme 7–11.2 cm long (including a peduncle 0.5–4.7 cm long) branched well above the base with flowers aggregated into umbelliform clusters; bracts of the rachis nodes paired below but quaternate above, linear-oblong to broadly triangular, 0.2–1.4 cm long, 0.1–0.2 cm wide, sparingly furfuraceous to essentially glabrous or with a few sinuate hairs on the adaxial surface, pustulate proximally on the abaxial surface, bracteoles sessile, persistent, triangular, 0.2–0.3 cm long, 0.1–0.2 cm wide, glabrous and pustulate basally on the abaxial surface. Pedicels 0.5–2.5 mm long, lanate. Hypanthia (at anthesis) campanulate, 2–3 mm long to the torus (vascular ring) with pubescence like that of the petioles. Calyx fused into a dome in bud but rupturing at anthesis into 5 broadly triangular hyaline lobes 0.25–0.50 mm long and 1.25–1.6 mm wide; exterior calyx teeth 5(–6), green (in fruit), narrowly triangular, 0.9–1.3 mm long, exceeding and obscuring the lobes, with pubescence like that of the hypanthia; torus glabrous and undulately lobed adaxially. Petals 5(–6), glabrous, pale pink, linear-oblong, obtuse to rounded apically, 2.5–4 mm long, 1 mm wide. Stamens 10(–12), isomorphic; filaments glabrous, somewhat geniculate distally, 1.2–2 mm long, 0.2–0.25 mm wide; anthers 1.1–1.5 mm long, 0.4–0.5 mm wide, yellow, linear-oblong, apically truncate with a somewhat dorsally inclined pore; connective thickened dorsally but not prolonged or appendaged at the filament insertion. Ovary (at anthesis) ⅔ inferior, 5-celled, globose, apex somewhat fluted and sparsely beset with glandular hairs, collar 0.25 mm high. Style somewhat curved distally, glabrous, 2.5–5 mm long, 0.5–0.6 mm wide; stigma truncate and somewhat dilated. Berry globose, pink to red but turning purple when mature, 4–5 mm long, 5 mm diam. Seeds angular-pyramidate to somewhat crescent-shaped in profile view, beige, ca. 0.5 mm long, smooth.

Distribution. Known only from the Tapantí National Wildlife Refuge on the northeastern slopes of the Cordillera de Talamanca and Braulio Carrillo National Park in the Cordillera Central where it occurs in the understory of wet primary forests near streams at elevations of 1,300–1,800 m. *Miconia pendula* may be expected elsewhere along the Atlantic montane corridor of the Cordillera de Talamanca that extends southward to Panama. *Clidemia utleyana* Almeda, *Gonocalyx almedae* Luteyn, *Monochaetum cordatum* Almeda, and *Stemodia reliquiarum* D'Arcy, all of which are known in Costa Rica only from the Tapantí region, have also been collected in western Panama.

Miconia pendula, which was first collected in 1984, is readily overlooked. The flowers are small, the petals fall away quickly, and the leaves are commonly so ravaged by phytophagous insects that collectors may be inclined to pass it up in hopes of finding undamaged material.

Miconia pendula differs from *M. friedmaniorum* in having modally larger 7-plinerved leaves, but its most striking feature is the complex lanate indument of contorted or sinuate multicellular hairs that grade into a ground layer of amorpho-pinoid hairs.

By virtue of their shared seed and petal characters, *M. pendula* and *M. friedmaniorum* appear to be related to a group of three largely Central American species that includes *M. iteophylla* Almeda, *M. ligulata* Almeda, and *M. peltata* Almeda (Almeda, 1989). These three species have rounded-triangular hyaline calyx lobes that are not fused into a rupturing dome as floral buds enlarge. Among this trio of species, the two new taxa described here are perhaps closest to *M. peltata*, which differs most conspicuously in its elliptic-ovate peltate leaves and indument of rusty brown pinoid hairs.

The epithet for this species alludes to the arcuate or nodding posture of the inflorescence.

Paratypes. COSTA RICA. CARTAGO: Tapantí Wildlife Refuge, Sendero Palmito, 5 Mar. 1992 (fr), *Almeda et al. 7245* (AAU, CAS, CR, DUKE, F, MO, NY, US); Tapantí Reserve ca. 1 km S of jct. of Quebrada Salta

and Río Grande de Orosi, 9°43′N, 83°47′W, 29 Sep. 1987 (fr), *Croat & Grayum 68255* (CAS, CR, MO); Tapantí Reserve, ca. 1 km upstream from confluence of Quebrada Salta and Río Grande de Orosi, 12 July 1984 (fl), *Grayum & Sleeper 3486* (CAS, CR, MO). HEREDIA: Parque Nacional Braulio Carrillo, San Rafael de Vara Blanca, 10°13′N, 84°06′W, July 1992 (fl), *Ballestero 157* (CR).

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A New Species of *Deprea* (Solanaceae) from Venezuela

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ABSTRACT. The range of the genus *Deprea* is discussed, and a new species, *Deprea hirtiflora*, from Venezuela, is described and illustrated. An overlooked, second species, *Deprea granulosa*, is also presented and illustrated.

Deprea Rafinesque is a small neotropical genus of Solanaceae. Its separation from *Physalis* was long ignored after first publication (Rafinesque, 1838), but the genus was reinstated by D'Arcy (1973), who also lectotypified it by *D. orinocensis* (Humboldt & Bonpland) Rafinesque. This view has been accepted by Hunziker (1977) and Barbosa & Hunziker (1989). The genus now includes eight species: the type species, *D. xalapensis* (Humboldt & Bonpland) Rafinesque, *D. sylvarum* (Standley & Morton) Hunziker, *D. glabra* (Standley) Hunziker, *D. cardenasiana* Hunziker, *D. granulosa* (Miers) Barbosa & Hunziker, *Deprea subtriflora* (Miers) D'Arcy, and the species described here. D'Arcy (1979, 1986, 1993) has indicated that although the corolla is more deeply divided in *Physalis subtriflora* (the type species of *Larnax* Miers) than in other species now placed in *Deprea*, this species is actually a member of *Deprea* and hence *Deprea* and *Larnax* are congeneric.

A difficulty in assessing the geographic range of *Deprea* is in the provenance of the specimens on which the original two species were described. In his description of *Deprea*, Rafinesque included *Physalis xalapensis* Kunth and *Physalis orinocensis* Kunth, both of which are typified by quite similar specimens in Paris (P). Subsequently, no species of *Deprea* has been found in the region around Xalapa, Mexico (Nee, 1986), the ostensible source of *Physalis xalapensis*, nor was any specimen of *Deprea* encountered from the region of the Orinoco, Venezuela, by D'Arcy, Benitez, and Nee, who have recently completed a treatment of the Solanaceae for the *Flora of the Guayana Highlands*. It is therefore reasonable to assume that the Kunth material actually came from somewhere other than Mexico or Venezuela. Plants similar to the material at Paris used by Kunth are commonly found in the uplands of Costa Rica and western Panama (D'Arcy, 1973), and also in Colombia.

After excluding Mexico and the Orinoco lowlands as part of the range of *Deprea*, the genus appears to range from Costa Rica to Colombia (*D. orinocensis*, *D. glabra*, *D. granulosa*), Ecuador (*D. glabra*), Peru (*D. subtriflora*), and Bolivia (*D. cardenasiana*). The species described here, *D. hirtiflora*, extends the range of the genus eastward into Trujillo, Venezuela, but not as far as the Orinoco basin.

Deprea hirtiflora Axelius & D'Arcy, sp. nov. TYPE: Venezuela. Trujillo: Mpio. de Bocano, camino al Cerro Guaramacal via la laguna de "Los Cedros," cloud forest, 21 Mar. 1981, *B. Stergios 2590* (holotype, MO). Figure 1A–C.

Species *Depreae orinicensi* (Kunth) Rafinesque affinis, a qua corolla azurea, extus dense villosa differt. Differt a *D. granulosa* (Miers) Barbosa & Hunziker colore corollae, pubescentia corollae densiore, tubo corollae breviore et antheris longioribus.

Branched, unarmed herb or shrub to 1.2 m tall, twigs terete, pubescent overall with conspicuous, weak, whitish 5–7-celled hairs that dry flattened, ribbonlike. Leaves subentire, ovate; blade mostly 3–5 × 1–3 cm wide, apically acuminate, basally obtuse, cuneate or acuminate, veins arcuate-ascending, ca. 5 on each side, not forming an evident submarginal vein, both sides evenly puberulent, slightly denser on the main veins beneath; petioles slender, 3–10 mm long. Inflorescences (1–3)-flowered fascicles terminal on peduncles in the leaf axils or branch forks, peduncle obsolete, pedicels slender, ca. 6 mm, puberulent. Flowers with fusiform buds; calyx pilose with elongate hairs, cupular, 5-lobate, lobed ¼-way down, the lobes small and narrowly triangular, ca. 0.5 mm long; corolla blue, tubular-infundibular, lobed ca. ⅓-way down, the lobes ca. 3 mm long, narrowly triangular, ciliolate, the tube ca. 5 mm long, slightly expanding upward, ca. 3 mm wide at the widest, villous outside, glabrous within;

Figure 1. A–C. *Deprea granulosa* (Miers) Hunziker & Barbosa. —A. Habit. —B. Flower. —C. Pubescence of leaf. After *Zarucchi 5157* (MO). D–H. *Deprea hirtiflora* Axelius & D'Arcy. —D. Habit. —E. Flower. —F. Flower opened to show stamens and style. —G. Pubescence of leaf. —H. Fruiting calyx with hole made to show fruit. After *Stergios 2590* (MO). Drawing by John Myers.

stamens 5, filaments inserted about ⅓-way up the corolla tube, slender, glabrous, anthers oblong, 2 × 0.8 mm, not apiculate; ovary rounded-conical, glabrous, style ca. 8 mm, slender, glabrous, stigma capitate. Fruit a globose berry, 5–9 mm; fruiting calyx subglobose, loosely enveloping the berry, open apically, 10-ribbed, overall pubescent; fruiting pedicels ca. 10 mm.

Deprea hirtiflora is only known from two collections made in páramo and cloud forest in upland Trujillo, Venezuela.

This species is distinctive in its dense pubescence of weak hairs that collapse on drying to appear flat and ribbonlike, and in its blue, ca. 5-mm-long corolla, which is densely hairy on the outside.

Paratype. VENEZUELA. TRUJILLO: Bocono, páramo Guaramacal, 2,640–2,700 m, 9°13′N, 70°13′W, 14 Mar. 1984, *Luteyn & Cotton 9707* (MO).

In most species of *Deprea* corolla tubes are glabrous outside, and the corolla lobes sometimes have granular to pubescent margins. In two species, however, the newly described *D. hirtiflora* and *D. granulosa* (Fig. 1D–G), the corolla is conspicuously pubescent with coarse, simple hairs. In *D. hirtiflora*, the hairs are dense and elongate and the corolla tube has a furry appearance, while *Deprea granulosa* has sparse, scattered hairs on the corolla. The general appearance of trichomes is similar in both species.

Deprea hirtiflora is very similar to *D. granulosa*, both being branched, unarmed herbs with weak, whitish pubescence. The leaves of *D. granulosa* are somewhat bigger (4–9 × 3–5 cm) than those in *D. hirtiflora*, it has longer petioles (8–20 mm), and its pedicels are longer (ca. 15 mm). The main differences are found in the flower: in *D. granulosa* the corolla is greenish yellow and much longer (8 mm vs. 5 mm), the anthers are shorter (1.5 mm vs. 2 mm), and the filaments are inserted relatively higher in the corolla tube.

Deprea granulosa is also apparently a rare species, though it was reported (Escobar, 1989) to be abundant in the vicinity of Medellín, Colombia. For our comparisons, we have seen three collections of it: Colombia. "N. Grenada, locis frigidis inter Ibaque et Cartago," *Goudot s.n.* (BM). Colombia. Antioquia: Mpio. de Medellín, Cerro del Padre Amaya, 8.4 km from Medellín–Santa Fe highway on road to the summit, 6°16′N, 75°41′W, 2,770 m, 30 Mar. 1987, *Zarucchi 5157* (HUA, MO). Colombia. Antioquia: Mpio. de Urrao, páramo de Frontino, El Río, 3,115 m, 10 Oct. 1984, *Ramira-Londono et al. 369* (MO). The first of these is an isotype of the species.

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Rafinesque, C. S. 1838. Sylva Telluriana. Rafinesque, Philadelphia.

A New Combination in *Exodeconus* (Solanaceae)

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ABSTRACT. *Cacabus flavus* is transferred to the genus *Exodeconus*.

The generic names *Exodeconus* Rafinesque (1838) and *Cacabus* Bernhardi (1839) are both based on the same type, *Physalis prostrata* L'Heritier de Brutelle. *Cacabus* was for many years erroneously used for this small group of plants from western South America, and not all necessary transfers into *Exodeconus* have been made. During a revision of the genus by Axelius, we examined the type collection of *Cacabus flavus* and considered it a species belonging to *Exodeconus*. We make the necessary new combination below.

In many species described in the same publication with *Cacabus flavus*, Johnston used the designation "type" and "isotype," also noting the herbarium of deposit for material upon which he based his species, a practice that did not come into general use until some years later. In the case of *Cacabus flavus*, his material was designated as "type, Gray Herb.," and another collection was cited as well. In accordance with present usage, we refer to the first as the holotype, a duplicate of it (which we have seen) as an isotype, and the second collection cited as a paratype. These were clearly Johnston's concepts, although all of these terms did not come into currency until much later.

Exodeconus flavus (I. M. Johnston) Axelius & D'Arcy, comb. nov. Basionym: *Cacabus flavus* I. M. Johnston, Contr. Gray Herb. 85: 177. 1929. TYPE: Peru. Arequipa: open rocky slopes, Tiabaya, 2,050 m, 8 Apr. 1925, *Pennell 13066* (holotype, GH; isotype, K).

Paratype. PERU. MOQUEGUA: dry ravines in hills SE of Moquegua, 1,550 m, 22–24 Mar. 1925, *Weberbauer 7459* (F, K).

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NOVON 3: 14. 1993.

Five New Tribes in the Scrophulariaceae

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ABSTRACT. Four new tribes of Scrophulariaceae are described: Alonsoeae, Bowkerieae, Caprarieae, and Freylineae. The Globulariaceae are given new status as a tribe in the Scrophulariaceae.

The relationships of many genera within the Scrophulariaceae are poorly understood. Thirty tribes are generally recognized, though some of these are clearly polymorphic and genera exist that do not fit within any recognized tribe. Recognition of the following tribes clarifies some of the relationships within the family.

Alonsoeae Barringer, tribus nov. TYPE: *Alonsoa* Ruiz & Pavón.

Herbae suffruticesve. Folia opposita vel verticillata. Inflorescentia centripeta, uniformis. Corolla explanato-rotata, resupinata, tubus nullus, labium posticum exterius. Stamina 4, antheris divaricatis vel in unam confluentes. Staminodia carentes. Capsula septicida, valvis integris bifidisve. Semina exarata.

Herbs or subshrubs. Leaves opposite or whorled. Flowers in terminal racemes or panicles, resupinate; lower bracts leaflike, the upper reduced. Pedicels ebracteolate. Calyx 5-parted, the lobes imbricate. Corolla rotate, resupinate, the lower lobes (from resupination) outermost in bud. Stamens 4, anthers unithecate and reniform or bithecate and parallel to divaricate; staminodes lacking. Ovary biloculate, with many ovules; stigma subcapitate. Capsule septicidal, the valves entire or bifid. Seed with a solid, longitudinally furrowed coat.

A single genus native to Andean South America, Central America, and South Africa:

Alonsoa Ruiz & Pavón, Syst. Veg. Fl. Peruv. Chil. 150. 1798. TYPE: *Alonsoa caulialata* Ruiz & Pavón fide Pennell (1920).

The true affinities of this tribe are difficult to discern. Bentham (1846) included it in the tribe Hemimerideae, but it is unlike any of the other genera in the tribe. Its often unithecate anthers, rotate corolla, and furrowed seeds are reminiscent of *Verbascum* L. It appears to be most closely related to *Verbascum* and *Scrophularia* L., which also have harpagioside and related 8β-8α-methyl substituted iridoids (Nicoletti et al., 1988). These compounds appear to mark a distinct clade within the Scrophulariales that also includes *Capraria* L. and the Pedaliaceae.

While most species of *Alonsoa* are neotropical, Roux (1985) and Steiner (1989) have found South African plants that they refer to the genus. Similar plants were described by Kunze (1841) as *Schistanthe* Kunze, because they differed from *Alonsoa* in having the corolla slightly saccate, the two lowermost corolla lobes split to the base and the capsules ovate, obtuse, and emarginate (Hilliard & Burtt, 1984). They also differ in having eliaophores in the corolla sacs similar to those found in the South African Hemimerideae and the neotropical Angeloneae and Melospermeae. Whether the South African species are placed in *Alonsoa* or *Schistanthe*, they are closely related to the South American species (Steiner, 1989) and would also be placed in this tribe.

Bowkerieae Barringer, tribus nov. TYPE: *Bowkeria* Harvey.

Frutex arboresve. Folia opposita vel verticillata. Inflorescentia composita, pedunculis cymoso-multifloris rarius unifloris bibracteatis. Corolla tubo brevi. Stamina 4 vel 2, antherarum loculis apice confluentibus. Staminodia parva vel carentes. Capsula septicida, valvis integris bifidisve. Semina reticulata.

Shrubs or small trees. Leaves opposite or verticillate. Flowers in terminal or axillary cymes, sometimes forming panicles; not resupinate; bracts grading into leaves. Pedicels ebracteolate. Calyx 5-lobed, rarely 3-lobed, lobes imbricate or valvate. Corolla campanulate to funnelform with a conspicuous sac or pouch in the distal half of the tube, the upper lobes exterior in bud. Stamens 4 with 1 staminode occasionally present, or stamens 2 with 2 or 3 staminodes, anthers confluent, reniform. Ovary biloculate or rarely triloculate, with many ovules; stigma punctiform or slightly bifid. Capsule septicidal, the valves sometimes bifid. Seed with loose, thin reticulate coat.

Three genera native to southern Africa:

Ixianthes Bentham, Companion Bot. Mag. 2: 54. 1835. TYPE: *Ixianthes retzioides* Bentham.

Anastrabe E. Meyer ex Bentham, Companion Bot. Mag. 2: 54. 1835. TYPE: *Anastrabe integerrima* E. Meyer.

Bowkeria Harvey, Thes. Cap. 1: 24, t. 37. 1859. TYPE: *Bowkeria triphylla* Harvey.

Bentham (1835, 1846) placed the genera in this tribe in the Cheloneae because of their cymose inflorescences. Within that tribe, he grouped it with African genera having inconspicuous staminodia or lacking them entirely. These genera are now segregated into the tribes Teedieae G. Don, Freylinieae Barringer, and Bowkerieae Barringer. The Bowkerieae differ from the Teedieae in having dehiscent capsules. They differ from the Freylineae in having a short corolla tube, valvate calyx, and confluent anthers. The seeds found in this tribe are similar to those of the Hemimerideae, but the Bowkerieae differ from that tribe in their shrubby habit, cymose inflorescences, and confluent anthers.

Hilliard (1969) pointed out the close relationship between *Anastrabe* and *Bowkeria*. *Ixianthes* is a rare, monotypic genus of shrubs with whorled, linear leaves, 3- or 5-parted calyx, and flowers with two stamens. It differs from the other two genera in the tribe by having more elongate corollas, but it shares with the others the saccate corolla, shrubby habit, and confluent anthers that distinguish the tribe.

Caprarieae Barringer, tribus nov. TYPE: *Capraria* L.

Herbae. Folia alterna. Inflorescentia centripeta. Corolla actinomorpha vel subzygomorpha campanulata lobis aequalibus. Stamina quinque vel quattuor aequales, antherarum loculis apice confluentis. Capsula loculicida. Semina reticulata.

Herbs. Leaves alternate. Flowers axillary or in terminal or axillary racemes. Bracteoles absent. Sepals 5, free or fused only at the base. Corolla actinomorphic or slightly zygomorphic, 5-lobed, broadly campanulate, not saccate or spurred, the lobes imbricate in bud, spreading. Stamens 5, inserted at the base of the corolla tube, the anthers exserted, bithecate, the thecae fused at the tip, divaricate. Stigma exserted, subcapitate to bilobed. Capsule loculicidal. Seed reticulate.

One genus native to Central America, western South America, and the Caribbean Islands, widespread as a weed in tropical regions:

Capraria L., Sp. Pl. 628. 1753. TYPE: *Capraria biflora* L.

Bentham (1876), Sprague (1921), and Thieret (1954) placed *Capraria* L. in the tribe Digitaleae near *Scoparia* L. and *Sibthorpia* L., two other genera with actinomorphic corollas and alternate leaves. Bentham's Digitaleae, like his Cheloneae, was a grab bag of genera that are best arranged into different tribes (Thieret, 1967), with *Capraria* in a tribe of its own.

The genus is unusual in the family. The leaves are alternate and spiral, the corolla is campanulate and often radially symmetrical. The pollen is tricolpo-diorate, an unusual type in the family found only in *Capraria* L. and a few species of *Mimulus* L. (Niezgoda & Tomb, 1975). It is one of the few Scrophulariaceae containing harpagide compounds, iridoid glycosides found more commonly in Pedaliaceae but also found in *Scrophularia* L. and its relatives (Heinrich, 1989). Classification of the genus is still unsettled. It appears to have some relationship to the tribe Leucophylleae and the Myoporaceae (Niezgoda & Tomb, 1975).

Freylinieae Barringer, tribus nov. TYPE: *Freylinia* Pangella.

Frutices suffruticesve. Folia opposita vel verticillata rarissime alterna. Inflorescentia composita, pedunculis cymoso-multifloris rarius unifloris bibracteatis. Corolla tubo infundibuliformi, labium posticum exterius. Stamina 4, antherarum loculis distinctis. Staminodia parva vel carentes. Capsula septicida, valvis integris bifidisve. Semina reticulata.

Shrubs or subshrubs. Leaves opposite or verticillate, rarely scattered along the stem. Flowers in terminal or axillary cymes, often secondarily clustered into panicles, bracts grading into leaves. Pedicels ebracteolate. Calyx 5-parted, lobes imbricate. Corolla tubular to funnelform, the upper lobes exterior in bud. Stamens 4, anthers with two parallel thecae. Staminodes short or absent. Stigma capitate, subcapitate, or sometimes slightly bifid. Capsule septicidal, secondarily loculicidal in *Freylinia*. Seed with thin reticulate exotesta.

Four genera native to southern Africa:

Phygelius E. Meyer ex Bentham, Companion Bot. Mag. 2: 53. 1836. TYPE: *Phygelius capensis* E. Meyer ex Bentham.

Freylinia Pangella ex Colla, Freyl. Gen. Add. Icon. (Hort. Ripul. 56). 1823. TYPE: *Freylinia cestroides* Colla.

Antherothamnus N. E. Brown, Hooker's Icon. Pl. t. 3007. 1915. TYPE: *Antherothamnus pearsonii* N. E. Brown.

Manuleopsis Thellung, Vierteljahr Nat. Ges. Zurich 60: 405. 1915. TYPE: *Manuleopsis dinteri* Thellung.

This tribe is related to the Bowkerieae, described above, and is distinguished from that tribe by its anthers with two parallel thecae and its elongate corolla tube. Bentham (1876) described *Phygelius* as having confluent anthers but, as Dyer (1975) pointed out, the anthers have two parallel thecae.

Globularieae (A. DC.) Barringer, stat. nov. Globulariaceae A. DC. in Lamarck & A. DC., Fl. Franç. 1805. TYPE: *Globularia* L.

Herbs or shrubs. Leaves alternate or rosulate. Flowers in globose capitula, terminal or rarely axillary; not resupinate; lower bracts not leaflike, forming an involucre. Calyx campanulate, 5-lobed, the lobes imbricate. Corolla tubular to funnelform, the upper lobes outermost in bud. Stamens 4 or rarely 2; staminodes lacking; anthers uniloculate, confluent. Ovary uniloculate, uniovulate; stigma subcapitate to minutely bifid. Fruit indehiscent. Seed with a solid, slightly reticulate coat.

Two genera native to the Mediterranean region of the Atlantic islands:

Globularia L., Sp. Pl. 95. 1754. TYPE: *Globularia vulgaris* L.

Poskea Vatke, Linnaea 43: 321. 1882. TYPE: *Poskea africana* Vatke.

Many authors recognize this group as a distinct family following Wettstein (1891), while others combine it with the genera of the tribe Selaginieae and recognize that group as a family following Bentham (1876). Hallier (1903) was the first to combine these groups with the Scrophulariaceae. There is a very strong relationship among the tribes Manuleae, Selagineae, and Globularieae. They appear to form a distinct clade within the family that is characterized by a reduction in ovule and seed number and consolidation of the flowers into more densely packed inflorescences.

Acknowledgments. I thank the curators of A, F, GH, MO, and NY for allowing me to study their collections. I also thank the librarians at NY and MO for their help.

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Orchidaceae Dunstervillorum VI: New Pleurothallidinae from the Venezuelan Guayana

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ABSTRACT. The following two taxa are proposed as new: *Pleurothallis erebatensis* and *Trichosalpinx oxychilos*. Both species are illustrated with plates by the late G. C. K. Dunsterville. Comments are provided on their relationships.

During preparation of the treatment of the Orchidaceae for the *Flora of the Venezuelan Guayana*, we have detected the following undescribed taxa in the subtribe Pleurothallidinae.

Pleurothallis erebatensis Carnevali & G. Romero, sp. nov. TYPE: Venezuela. Bolívar: Municipio Sucre, alrededores de Santa María de Erebato, 4°59′N, 64°49′W, 360 m, feb. 1989, *Elio Sanoja 2554* (holotype, PORT; isotypes, MO, VEN). Figure 1.

Species haec *P. aphtosae* Lindley affinis, sed planta minore, ovario glabro, sepalis extus conspicue carinatis, minute papillosis non conspicue pubescentibus, intus glabrescentibus non verruculosis, dorsali base non atenuato, synsepalo versus apicem connatis, labello angustiore discrepat.

Epiphytic herbs, caespitose to shortly creeping, erect to subpendent; rhizome covered with scarious sheaths. Stems (1.5–)3–8.5 cm long, terete, the basal ⅓–½ clothed in a close-fitting tubular brown sheath. Leaves 5.5–9.5 cm long, (1–)1.3–1.8(–2) cm wide, fleshy-coriaceous when fresh, coriaceous when dry, erect on the stem, narrowly elliptic to oblanceolate, apex obtuse to acute, the midnerve sulcate, dorsally angled. Inflorescences 5–10 mm long, 1–5, successive or 2 or 3 simultaneously, erect or deflexed downward; peduncle very short and completely covered by a sheath at the base of the leaf; rachis completely covered by the floral bracts, 4–7-flowered; floral bracts ca. 2 mm long, fleshy, broadly cupuliform, apex acute, dorsally carinate. Flowers resupinate or not, dark brownish red, opening ± simultaneously; pedicel 0.9–1.1 mm long, terete, ovary 1.2–1.5 mm long, glabrous, terete. Sepals thick-fleshy, 3-nerved, dorsally prominently carinate, finely papillose on both surfaces but more conspicuously so without, apices sharply mucronate; dorsal sepal 4.8–5 mm long, 1.8–2 mm wide, concave, oblong to elliptic-oblanceolate when flattened, acute, forming a hood over the column; lateral sepals connate for ⅝ of their length into a concave synsepal 4.9–5.1 mm long, when spread 4.3–4.4 mm wide, basally produced into a prominent mentum. Petals 2.4–2.6 mm long, 0.9–1.1 mm wide, thin but fleshy, 1-nerved, oblanceolate to obtrullate, obtuse, margins in the apical half finely and irregularly erose, glabrous. Labellum 3–3.2 mm long, 1–1.1 mm wide in natural shape, 1.5 mm wide when flattened, 3-nerved, concave, narrowly oblanceolate in natural shape, becoming oblong-elliptic to elliptic when spread, rounded to obtuse, fleshy, thicker at middle, basally with a pair of minute, retrorse lobules, anterior margin erose-laciniate; disk covered with pubescence of hairs in transverse lamellalike rows, coarser in the apical half; callus composed of 2 submarginal, parallel keels with erose dentate margins, located in the middle ⅓ of the labellum. Column 1–1.3 mm long, straight or ± arcuate; margins prominently winged, apically 3-lobed, basally produced into a conspicuous foot 1–1.3 mm long. Fruits 0.9–1.3 mm long, obliquely ellipsoid. (Subg. *Acianthera* (Scheidweiler) Luer, sect. *Brachystachyae* Lindley.)

Pleurothallis erebatensis resembles several others in section *Brachystachyae*, and it is difficult to

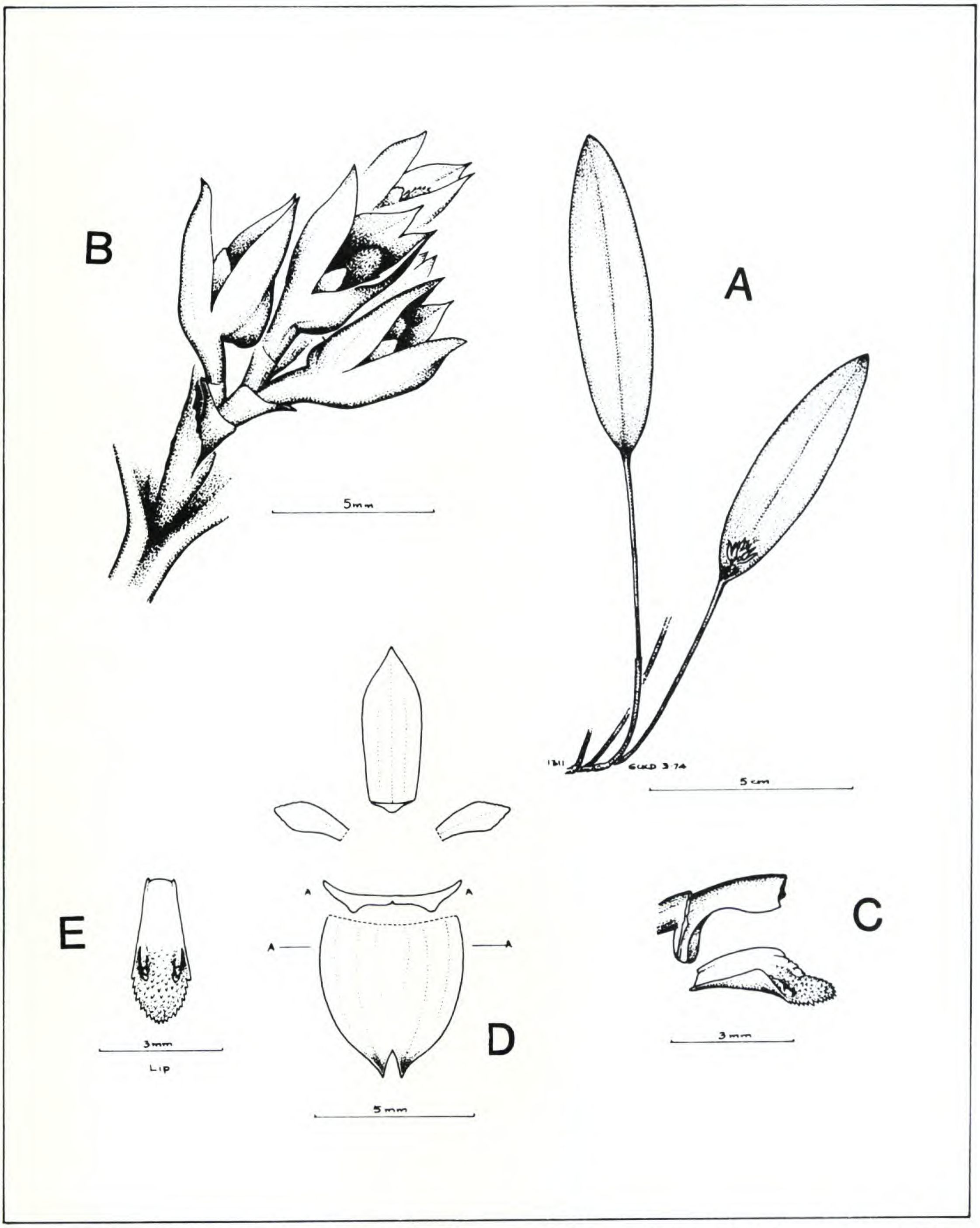

Figure 1. *Pleurothallis erebatensis* Carnevali & G. Romero. —A. Flowering habit. —B. Inflorescence. —C. Lateral view of labellum and column. —D. Sepals and petals, spread. —E. Labellum, spread. (Based on *Dunsterville & Dunsterville 1311.*)

ascertain which is its closest relative. It is similar to *Pleurothallis aphtosa* Lindley, from Colombia, Bolivia, Paraguay, and southern Brazil, from which it is easily distinguished by its smaller vegetative and floral stature, its conspicuously dorsally carinate sepals that are papillose without and glabrescent within (pubescent without and verruculose within in *P. aphtosa*), the synsepal connate almost to the apex, and a narrower labellum. The collectors of the new species have not described the fragrance of the

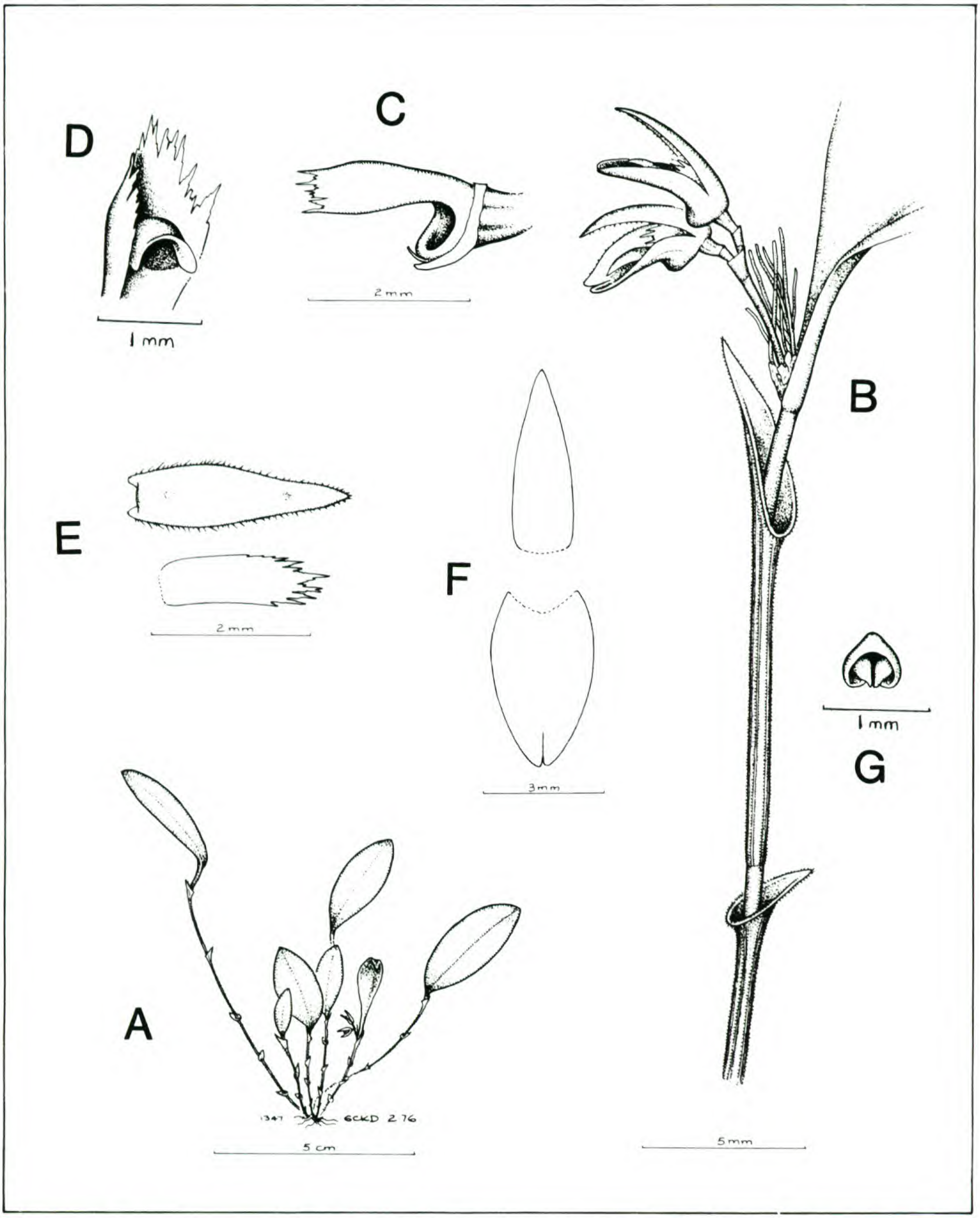

Figure 2. *Trichosalpinx oxychilos* Carnevali & G. Romero. —A. Habit. —B. Detail of stem, base of leaf and inflorescence. —C. Lateral view of column. —D. Clinandrium. —E. Labellum and petal. —F. Sepals, spread. —G. Anther and pollinia. (Based on *Dunsterville & Dunsterville 1347.*)

flowers, but it is likely to be similar to that of *Pleurothallis aphtosa*. A plant illustrated as *P. aphtosa* from Bolivia (*Vazquez 177*, Herbarium Vasquezianum, Dodson & Vázquez, 1990, t. 276) is most likely a variant of *Pleurothallis erebatensis*.

Paratypes. VENEZUELA. BOLIVAR: vic. of Sta. María de Erebato, 400 m, Mar. 1974, *Dunsterville & Dunsterville 1311* (AMES). TACHIRA: 10 km E of La Fundación, around Represa Dorada, 600–1,000 m, 10–13 Mar. 1981, *Liesner & González 10257* (VEN), *Liesner & González 10400* (MO, VEN).

Trichosalpinx oxychilos Carnevali & G. Romero, sp. nov. TYPE: Venezuela. Bolívar: Cerro Jaua, ca. 1,800 m, Feb. 1976, *G. C. K. Dunsterville & E. Dunsterville 1347* (holotype, AMES). Figure 2.

Species haec *Trichosalpingi orbiculari* (Lindley) Luer affinis sed foliis angustioribus subpetiolatis, sepalis lateralibus alte connatis (⅔ vs. ¼–½ longitudine) recedit.

Epiphytic herbs, caespitose, 7–11 cm tall. Rhizome abbreviated. Stems 2.5–7.5 cm long, erect, terete, laxly enveloped by 4 or 5 lepanthiform sheaths; sheaths close-fitting, tubular, nervose, hispidulous, the apex expanded, the uppermost sheath generally elongate, less wide-spreading. Leaves 2.2–4 cm long, 0.75–1.4 cm wide, moderately fleshy, elliptic to narrowly elliptic, apex obtuse to broadly obtuse, base tapering, slender and twisted forming a channeled pseudopetiole 4–10 mm long. Inflorescences from stem apex, successive, 2-flowered, suberect, ca. 3.5 mm long; peduncle terete, slender, with a cupuliform sheath at apex; rachis very abbreviated. Flowers small, resupinate, suberect or horizontally patent, subcampanulate; floral bracts subhyaline, tubular, ca. 0.6 mm long; pedicel subterete, ca. 1.3 mm long; ovary obconic, 0.8–1.3 mm long. Sepals pale brown with red flushing yellow toward apex, concave, dorsal surface rugulose, margins sparsely ciliate or with short narrow teeth; dorsal sepal 4.3 mm long, 1.4 mm wide, narrowly lanceolate, acute, 3-nerved; lateral sepals connate for ⅔–¾ of their length into a lanceolate or elliptic, obtuse synsepal, 4.4 mm long, 2.4 mm wide, basally produced into a pronounced mentum. Petals ca. 2 mm long, 0.5 mm wide, thin, translucent white, parallel to column, 1-nerved, oblong, apex long-lacerate. Labellum 2.3 mm long, 0.8 mm wide, red with yellow at apex and along the lightly sunken midnerve, articulate to and attached to the column by a very short, narrow, thin lamina; blade 3-nerved, narrowly lanceolate, acute, margins ciliate, basally provided with 2 minute, retrorse, white lobules. Column ca. 2 mm long, white with some red at base, with a pronounced, fleshy foot; clinandrium long-lacerate; anther fleshy, white; pollinia 2, white, waxy; rostellum strongly hooded.

This new species belongs to a small complex within subgenus *Trichosalpinx*, characterized by an acute labellum that is longer than the petals. *Trichosalpinx oxychilos* seems to be most closely related to *T. orbicularis*, but differs in its narrower leaves and less spreading lateral sepals that are basally connate for ⅔–¾ of their length. In addition, the ostia of the lepanthiform sheaths are less expanded in *T. oxychilos* than in *T. orbicularis*, and the margins of the sepals are ciliate in *T. oxychilos*, whereas in *T. orbicularis* they are glabrous or rarely provided with sparse, minute hairs. Both species seem to differ also in their ecological preferences, at least in the Venezuelan Guayana: *Trichosalpinx oxychilos* has been collected on summits of sandstone mesas at ca. 1,800 m, while *T. orbicularis* is basically a lowland species, known from elevations of 100–700(–900) m.

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A New Combination in *Deprea* (Solanaceae)

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ABSTRACT. *Physalis subtriflora*, type species of the genus *Larnax*, is transferred to the genus *Deprea*.

Previous comments (D'Arcy, 1979, 1986) that *Larnax* Miers (1849) is congeneric with *Deprea* Rafinesque (1838) are confirmed by the combination made here, which places the type species of *Larnax* in *Deprea*. Both this species and the type of *Deprea* were first described as members of *Physalis*, from which they differ in their woody habit, lobed corollas, and general appearance. The corolla lobing in *Deprea subtriflora* is deeper, more than halfway down, which led Hunziker (pers. comm.) to recognize the separation of *Larnax*. This difference does not seem to be of generic import. Other details accord with those of species now recognized as *Deprea*. The present concept conforms with that of Miers, whose genus *Larnax* embraced the type species of both *Larnax* and *Deprea* (*D. orinocensis* (Kunth) Rafinesque). When Hunziker (1977) resurrected *Larnax* as a genus, he did not note any differences between it and *Deprea*.

Deprea subtriflora (Ruiz & Pavón) D'Arcy, comb. nov. Basionym: *Physalis subtriflora* Ruiz & Pavón, Fl. Peruv. 2: 42. t. 178a. 1799. TYPE: Peru. Lima: Canta Prov., around Obragillo and S. Bonaventura, *Pavón s.n.* (not seen).

Larnax subtriflora (Ruiz & Pavón) Miers, Ann. & Mag. Nat. Hist. Ser. 2. 4: 38. 1849.

Withania subtriflora (Ruiz & Pavón) Dunal in de Candolle, Prodromus 13(1): 455. 1852.

Athenaea subtriflora (Ruiz & Pavón) A. Zahlbruckner, Ann. K. K. Naturhist. Hofmus. 7: 8. 1892.

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Rafinesque, C. S. 1838. Sylva Telluriana. Rafinesque, Philadelphia.

A New Species, *Pogonophora letouzeyi* (Euphorbiaceae), from Gabon

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ABSTRACT. A species from the Crystal Mountains in Gabon, whose name was previously invalidly published, is here named *Pogonophora letouzeyi* to honor René Letouzey.

As recently pointed out by Molloy et al. (1992), the description of *Pogonophora africana* by Letouzey (1969) was published with the mention of two "holotypes," one from a female plant (*N. Hallé 645*), the other one from a male plant (*N. Hallé & J. F. Villiers 4648*). This is in contradiction with the *International Code of Botanical Nomenclature* (Greuter et al., 1988: Art. 9.1), which states that the holotype of a specific taxon "is a single specimen or illustration." These collections could only be considered as syntypes. The *ICBN* (Art. 37.1) reads: "Publication on or after 1 Jan. 1958 of the name of a new taxon of the rank of genus or below is valid only when the holotype of the name is indicated." Therefore, *P. africana* Letouzey is invalid, and the two specimens cited by Letouzey are not types of any kind.

A holotype could be selected to validate the name. It would change the authorship of the species and, in my opinion, it would be regrettable to take away from my late colleague René Letouzey the recognition now attached to the name of this species. To avoid this, I here name the species in honor of Letouzey as a tribute to his vast knowledge of the African flora and vegetation. He had a special interest in Cameroon, and in the affinities between the flora of tropical America and the coastal flora of the Guinea Gulf in Africa. *Pogonophora* Miers ex Bentham, with one or two species in Amazonian South America and one in Gabon, is a good example of what he called, in the neighboring western Cameroon, the "vestiges d'une 'forêt archaïque à affinités sud-américaines'" (Letouzey, 1968: 148).

Pogonophora letouzeyi Feuillet, sp. nov. TYPE: Gabon. Estuaire: bordure des monts de Cristal, chutes de Kinguélé, bord de rivière sur plage sableuse, 100 m, Jan. 1968 (pist. fl), *N. Hallé & J. F. Villiers 4648* (holotype, P).

Pogonophora africana Letouzey, nom. inval., Adansonia, sér. 2, 9(2): 275. 15 July 1969.

For the description in Latin and in French, and the illustration, see Letouzey (1969).

Distribution. In open vegetation, river sandy beach and scrubby vegetation, northeast of Libreville, Gabon, western limit of the Crystal Mountains range, at elevations around 100 m.

The female plant kept at P is selected as the holotype, because, according to Letouzey, the characters it shows were more critical than those of the previous collection in identifying the generic affinities of the species.

Paratype. GABON. ESTUAIRE: brousse secondaire près de Nkoulounga, 55 km NE Libreville, June 1959 (stam. fl), *N. Hallé 645* (P).

Acknowledgments. My special thanks to Lynn Gillespie who reassured me about the placement of this taxon in *Pogonophora* and to Dan Nicolson who checked that all the *Code*'s requirements were satisfied.

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Cambios Nomenclaturales en *Eriosema* (Fabaceae: Cajaninae)

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RESUMEN. Se propone sinonomia nueva en *Eriosema crinitum* y *E. simplicifolium*, y se presenta la combinación *E. crinitum* var. *stipulare* (Bentham) Fortunato.

ABSTRACT. New synonymy is proposed in *Eriosema crinitum* and *E. simplicifolium*, and the combination *E. crinitum* var. *stipulare* (Bentham) Fortunato is made.

Eriosema (DC.) Desvaux comprende alrededor de 130 especies de distribución pantropical y subpantropical, de las cuales 37 crecen en América.

Este género es bastante uniforme, con pocos caracteres diferenciales, siendo difícil establecer divisiones infraespecíficas que agrupen especies. Asimismo, la mayoría de ellas se distinguen por caracteres foliares, variables según el ambiente, lo cual dificulta su limitación y en muchos casos se observan numerosos complejos de dos o más especies de dificultosa separación.

A través del estudio que se está realizando para distintas floras de América, se pretende efectuar una nueva revisión del género *Eriosema*. Como una primera contribución se presenta la taxonomía de *E. crinitum* (HBK) G. Don y *E. simplicifolium* (HBK) G. Don, ambas de amplia distribución en el continente americano.

La sinonomia sigue Grear (1970), con excepción de algunos casos debidamente indicados.

1. Eriosema crinitum (HBK) G. Don, Gen. Hist. 2: 1832. Basónimo: *Glycine crinita* HBK, Nov. Gen. & Sp. 6: 421. 1823. Atlas band: 573. (reprint 1963). *Rhynchosia crinita* (HBK) DC., Prodr. 2: 389. 1825. TIPO: Venezuela. "Montosis Novae Andalusiae, in Cerro del Cocollar, alt. 408 hex.," *Humboldt & Bonpland s.n.* (no visto).

Euriosma barbata Desvaux, Ann. Sci. Nat. Bot., ser. 1, 9: 422. 1826. TIPO: in Peruvia (no visto).

Eriosema conwayi Rusby, Bull. New York Bot. Gard. 6: 516. 1910. TIPO: Bolivia. Apolo, *Williams 9* (lectotipo, NY; isolectotipo, K no visto); hills near Apolo, 6,000 ft., *Williams 117* (sintipos, BM no visto, K, NY).

Eriosema pinetorum Standley, Field Mus. Publ. Bot. 8: 315. 1931. TIPO: British Honduras. All Pines, *Schipp 584* (holotipo, F; isotipos, A no visto, BM no visto, G no visto, GH, K, NY, S no visto, UC no visto).

Eriosema adumbratum Pittier, Bol. Téc. Caracas 5: 47. 1944. TIPO: Venezuela. Andina, señalada en Trujillo y Mérida, entre 1,500 y 2,100 m, *Lasser 316* (holotipo, VEN no visto; isotipo, US).

Esta especie presenta un gran polimorfisino en sus caracteres vegetativos. De lo estudiado hasta el momento, se pueden diferenciar cuatro grupos morfológicos muy próximos entre sí, existiendo incluso algunos ejemplares que presentan caracteres intermedios de difícil separación. Esta variación se encuentra en áreas donde conviven las entidades. No obstante, en la mayoría del material estudiado se mantienen las diferencias observadas para los cuatro grupos, y como esas diferencias poseen cierta relación con la distribución geográfica, se ha preferido mantener esos grupos separados a través del rango varietal.

CLAVE DE LAS VARIEDADES DE *ERIOSEMA CRINITUM*

1a. Folíolo medio en la mayoría de las hojas más de 5 veces más largos que anchos.
  2a. Tallos y folíolos con pubescencia amarillo-, rufo-pilosa o glabros; inflorescencias 2–8-floras ..... *E. crinitum* var. *crinitum*
  2b. Tallos y folíolos con pubescencia albo-pilosa; inflorescencias 1–4-floras ..... *E. crinitum* var. *stipulare*
1b. Folíolo medio en la mayoría de las hojas menos de 5 veces más largos que anchos.
  3a. Tallos y folíolos con pubescencia albo-pilosa, adpresa o patente; inflorescencias 1–4-floras ..... *E. crinitum* var. *pulchellum*
  3b. Tallos y folíolos con pubescencia amarillo o rufo-pilosa, patente; inflorescencias 3–10-floras ... *E. crinitum* var. *macrophyllum*

Eriosema crinitum var. **crinitum**

Esta variedad es afín a *E. longifolium* Bentham (centro y sudeste de Brasil y centro de Paraguay) y a *E. strictum* Bentham (centro este de Brasil, este de Paraguay y oeste de Bolivia) por presentar tallos erectos a ascendentes y folíolos lanceolados a angostamente ovados. No obstante, *E. longifolium* se diferencia principalmente por tener cáliz de mayor tamaño (8–12 mm long.) e inflorescencias plurifloras

(más de 8 por racimo); *E. strictum* se caracteriza por poseer folíolos pubérulos en la cara adaxial y seríceos en la abaxial; mientras que *E. crinitum* var. *crinitum* presenta cáliz de 4–6 mm long., inflorescencias paucifloras (2–8 por racimo) y folíolos amarillo-, rufo-pilosos o glabros en ambas caras.

Distribución. Crece en suelos arenosos de sabanas y cerrados. Variedad de amplia distribución, común desde México hasta el sudeste de Brasil, rara en Bolivia y Perú.

Eriosema crinitum var. **stipulare** (Bentham) Fortunato, stat. nov. Basónimo: *Eriosema stipulare* Bentham, Linnaea 22: 519. 1849. TIPO: Brasil. Goiás: ad San Izidro, *Pohl s.n.* (lectotipo, aquí designado, K; fotografía, BAB); Mato Grosso, 1838–1839, *Riedel s.n.* (sintipo, K; fotografía, BAB).

Grear (1970) señaló al ejemplar *Pohl s.n.* como holotipo de *E. stipulare.* Bentham (1849) en la descripción original del binomio, citó dos sintipos sin especificar un holotipo: *Pohl s.n.* y *Riedel s.n.* En esta nota, se ha preferido seleccionar lectotipo del epíteto al ejemplar de *Pohl s.n.* porque el material de *Riedel s.n.* de Mato Grosso puede ser confuso. Dicho material está constituido por tres ramas semejantes, montadas en una misma hoja de herbario, pero coleccionadas en distintas fechas y con diferente número de etiqueta: 1838 No. 23, 1838 No. 72, y 1839 No. 90. Es probable que esos números correspondan a una numeración de campo. A pesar de las distintas fechas de colección puede ser que Bentham, al no observar diferencias entre las tres ramas, citó a todas bajo *Riedel s.n.*

Con el estudio del material, en especial de Brasil y Venezuela, de *E. crinitum* y *E. stipulare*, se observó que los únicos caracteres que las separan son los citados en la clave, por tal motivo se propone para *E. stipulare* un nuevo status: *E. crinitum* var. *stipulare.*

Distribución. Común en suelos arenosos de pasturas graminosas, sabanas y cerrados, crece en Costa Rica, Colombia, Venezuela, Guyana hasta el norte y centro de Brasil.

Eriosema crinitum var. **pulchellum** Bentham, Fl. Bras. 15(1): 209. 1859. TIPO: Brasil. "In glareosis prope Tejuco," *Riedel 608* (lectotipo, aquí designado, K; fotografía, BAB); Brasil. Rio Grande, 1837, *Tweedie s.n.* (sintipo, K no visto; fotografía, BAB).

Eriosema fusiformis Rusby, Bull. New York Bot. Gard. 6: 516. 1910, sin. nov. *Eriosema crinitum* var. *fusiformis* (Rusby) Grear, Mem. New York Bot. Gard. 20(3): 49. 1970. TIPO: Bolivia. Prairies, Apolo, *Williams 29* (holotipo, NY; isotipos, BM no visto, K, US).

Bentham (1859) diferenció a la variedad *pulchellum* por presentar folíolos anchos ("foliolis latioribus") citando en la diagnosis original nueve sintipos: in glareosis prope Tejuco, *Riedel s.n.;* Rio Grande, *Tweedie s.n.;* in campis humidis, prov. Goyazensis et Minarum, *Weddell s.n.;* in campis editis prov. Minarum australioris, *Martius s.n.;* in prov. Minarum, *St. Hilaire s.n.; Claussen s.n.;* in prov. S. Pauli, *St. Hilaire, s.n.;* Goyaz, *Gardner 3108;* in prov. S. Pauli, *Guillermin 481.*

Posteriormente, Grear (1970) consideró a esta variedad como sinónimo de *E. stipulare* Bentham y seleccionó lectotipo del epiteto varietal al ejemplar *Gardner 3108* (BM). Este autor realizó dicha sinonimia a pesar que *E. stipulare* se caracteriza por presentar folíolos oblongo-lanceolados, lineares a angostamente ovados. Asimismo, en su monografía, Grear no cita ninguno de los sintipos de *E. crinitum* var. *pulchellum* con excepción del ejemplar *Gardner 3108.*

Hasta el momento, de los nueve sintipos de variedad *pulchellum*, solo se pudo consultar cuatro. En ese material tipo se comprobó que existen tres grupos morfológicos diferentes:

(1) Con folíolos oblongo-lanceolados, cinco veces más largos que anchos y albo-pilosos (*Gardner 3108 = E. stipulare*).

(2) Con folíolos ellipticos a ovados, menos de cinco veces más largos que anchos y rufo-pilosos (*Guillermin 481*, K).

(3) Con folíolos elípticos a ovados, menos de cinco veces más largos que anchos y albo-pilosos (*Riedel 608* y *Tweedie s.n.*, K).

Los grupos dos y tres pertenecen a plantas de folíolos anchos y se diferencian por la coloración de la pubescencia. En dos, *Guillermin 481* (K) corresponde a *E. crinitum* var. *macrophyllum* por presentar el cáliz floral con pelos glandulosas, pluricelulares y pubescencia rufa en tallos y folíolos. Asimismo, el material del grupo tres es fácilmente distinguible y corresponde a una variedad de *E. crinitum* que Grear consideró en 1970: *E. crinitum* var. *fusiformis.*

Es probable que en los cinco sintipos que aún faltan consultar del epíteto varietal, también exista mezcla de diferentes tipos exomorfológicos de *E. crinitum* o de otras especies afines. No obstante como Bentham describió la variedad *pulchellum* para plantas de folíolos anchos, en esta nota se propone:

(a) Modificar la lectotipificación de *E. crinitum* var. *pulchellum* realizada por Grear, dado que el

ejemplar *Gardner 3108* no solo no posee el caracter diagnóstico del epíteto, sino que además pertenece a otro taxón: *E. stipulare*.

(b) Seleccionar para *E. crinitum* var. *pulchellum* un nuevo lectotipo: *Riedel 608* (K). Se ha preferido este material por ser más completo (dos ramas) que el ejemplar de *Tweedie s.n.* (K). El material de *Guillermin 481* (K), no fue considerado en esta selección porque pertenece a otro taxón: *E. crinitum* var. *macrophyllum*.

(c) Sinonimizar a *E. crinitum* var. *fusiformis* con *E. crinitum* var. *pulchellum*, ya que mediante la lectotipificación efectuada en el punto (b) no existen diferencias entre ambos epítetos.

Esta variedad fue citada por Grear (*E. crinitum* var. *fusiformis*) para la Argentina sobre la base de dos ejemplares de la provincia de Corrientes: *T. M. Pedersen 528* y *5852*. A estudiar estos ejemplares se comprobó que pertenecen a otra especie del complejo *E. campestre* Bentham, actualmente en estudio.

Distribución. Posee áreas disyuntas; se la encuentra en campos y cerrados de Centroamérica y del este de Bolivia, centro y sur de Brasil y centro de Paraguay.

Eriosema crinitum var. **macrophyllum** Grear, Mem. New York Bot. Gard. 20(3): 52. 1970. TIPO: Brasil. Distrito Federal, summit of Chapada da Contagen, ca. 10 km este of Brasilia, elev. 1,100 m, *Irwin, Souza & Reis dos Santos 11593* (holotipo, NY; isotipos, F, GH, IAN no visto, K, MO, UB no visto, US).

Esta variedad es afín a *E. pycnanthum* Bentham por presentar folíolos menos de cinco veces más largos que anchos y pubescencia amarillo a rufo-pilosa. No obstante, *E. pycnanthum* se diferencia por poseer folíolos agudos, mucronados, cuneados en la base y vexilo de 12–14 mm long.

Distribución. Se encuentra en suelos arenosos y más o menos rocosos de cerrados y pasturas graminosas. Crece en el sudeste de Brasil, centro de Paraguay, y nordeste de la Argentina.

2. Eriosema simplicifolium (HBK) G. Don, Gen. Hist. 2: 348. 1832. Basónimo: *Glycine simplicifolia* HBK, Nov. Gen. & Sp. 6: 419. 1823. *Rhynchosia simplicifolia* (HBK) DC., Prodr. 2: 389. 1825. TIPO: Venezuela. Prope Atures, ad cataractas Orinoci, *Humboldt & Bonpland s.n.* (holotipo, B destruido; fotografía No. serie F 2427: F, SI).

Neurocarpum barbatum Desvaux, Ann. Sci. Nat. Bot., sér. 1, 9: 412. 1826. TIPO: Hab. in Brasiliâ (no visto).

Eriosenia lanceolatum Bentham, Ann. Nat. Hist. 3: 438. 1839. TIPO: Guyana. *Schomburgk 651* (holotipo, K; isotipos, F, G no visto, GH, BM no visto, LE no visto, NY, US).

Eriosema simplicifolium var. *micranthum* Grear, Mem. New York Bot. Gard. 20(3): 88. 1970, sin. nov. TIPO: Brasil. Goiás, Serra do Caiapó, ca. 20 km S of Caiaponia on road to Jataí, elev. 800–1,000 m, *Irwin & Soderstrom 7628* (holotipo, NY; isotipos, BM no visto, F, GH, IAN no visto, K, MO, UB no visto, US).

Grear (1970) diferenció a *E. simplicifolium* var. *micranthum* por presentar hábito erecto a decumbente, folíolos estrigosos en la cara adaxial, flores de 8–11 mm long. y pedúnculos más anchos que en la variedad típica. Asimismo, este autor señaló para la var. *micranthum* una distribución geográfica localizada en: Paraguay, Bolivia, y centro este de Brasil. A través de una reciente publicación (Juarez, F., 1986) se extendió el área hasta el noroeste argentino.

Al estudiar esta especie se observó un gran polimorfismo en los caracteres descriptos, existiendo numerosos ejemplares de dudosa ubicación varietal. Ante la no presencia de caracteres estables que sirvan para separar taxonómicamente diferentes tipos morfológicos, se considera probable que la variabilidad observada está relacionada al medio en donde crece la planta dada la amplia distribución en el continente que posee la especie.

Entre las especies de hojas unifolioladas, *E. simplicifolium* es afín a *E. heterophyllum* Bentham del sureste y centro de Brasil. Ambas entidades se caracterizan por presentar folíolos lanceolados, ovados, elípticos o cordados, estípulas connatas, persistentes y flores de 7–15 mm long. No obstante *E. simplicifolium* se diferencia por poseer folíolos lanceolados, ovados a elípticos, raro cordados, inflorescencias generalmente menores que las hojas, 2–10-floras. Por su parte *E. heterophyllum* se distingue por presentar folíolos ovados a cordados e inflorescencias generalmente mayores que las hojas, 8–15-floras.

Distribución. Crece en sabanas, cerrados y pastizales. Común desde Costa Rica, Antillas hasta el centro y sureste de Brasil, centro y sur de Bolivia, norte de Paraguay y noroeste de la Argentina.

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New Combinations in *Hippeastrum*, *Ismene*, and *Leptochiton* (Amaryllidaceae) for the Flora of Peru

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ABSTRACT. Thirteen new combinations are provided for Peruvian species of Amaryllidaceae: *Hippeastrum bukasovii* (Vargas) Gereau & Brako, *Hippeastrum cuzcoense* (Vargas) Gereau & Brako, *Hippeastrum ferreyrae* (Traub) Gereau & Brako, *Hippeastrum hugoi* (Vargas) Gereau & Brako, *Hippeastrum intiflorum* (Vargas) Gereau & Brako, *Hippeastrum leonardii* (Vargas) Gereau & Brako, *Hippeastrum macbridei* (Vargas) Gereau & Brako, *Hippeastrum variegatum* (Vargas) Gereau & Brako, *Ismene hawkesii* (Vargas) Gereau & Meerow, *Ismene morrisonii* (Vargas) Gereau & Meerow, *Ismene ringens* (Ruiz & Pavón) Gereau & Meerow, *Ismene sublimis* (Herbert) Gereau & Meerow, and *Leptochiton helianthus* (Ravenna) Gereau & Meerow.

During the inventory of Peruvian Amaryllidaceae for the *Catalogue of the Flowering Plants and Gymnosperms of Peru* (Zarucchi & Brako, in prep.), it became clear that the following new combinations are needed to treat the Peruvian species in accordance with current nomenclatural rules and the generic concepts employed by Meerow (1990) in the *Flora of Ecuador*.

1. *HIPPEASTRUM* HERBERT

Based on the lectotypification of *Amaryllis* L. proposed first by Hitchcock (1929: 145) and the lectotypification of its type species *A. belladonna* L. proposed by Sealy (1939) and accepted by Dandy & Fosberg (1954), Goldblatt (1984) proposed the conservation of *Amaryllis* for the single South African species. The unanimous acceptance of this proposal by the Committee for Spermatophyta (Brummitt, 1987) resulted in the authorization of its use in this sense under Article 15 of the *International Code of Botanical Nomenclature* (Greuter et al., 1988: 178) and necessitates the transfer of all New World species formerly included in *Amaryllis* to the conserved genus *Hippeastrum*. The following new combinations are needed for species occurring in Peru:

Hippeastrum bukasovii (Vargas) Gereau & Brako, comb. nov. Basionym: *Amaryllis bukasovii* Vargas, Pl. Life 31: 30. 1975. TYPE: Peru. Puno: Prov. Sandía, bridge at San José, 1,400–1,800 m, *C. Vargas C. 21882* (holotype, CUZ).

Hippeastrum cuzcoense (Vargas) Gereau & Brako, comb. nov. Basionym: *Amaryllis cuzcoensis* Vargas, Pl. Life 31: 32. 1975. TYPE: Peru. Cuzco: Prov. Calca, Hacienda Vilcabamba, 2,800 m, *C. Vargas C. 22395* (holotype, CUZ; isotype, USM).

Hippeastrum ferreyrae (Traub) Gereau & Brako, comb. nov. Basionym: *Amaryllis ferreyrae* Traub, Pl. Life 6: 62. 1950. TYPE: Peru. Loreto: Isla Santa María, near Yurimaguas, Huallaga Valley, 150–200 m, *R. Ferreyra 4497* (holotype, MO).

Hippeastrum hugoi (Vargas) Gereau & Brako, comb. nov. Basionym: *Amaryllis hugoi* Vargas, Herbertia 40: 126. 1984. TYPE: Peru. La Libertad: Prov. Bolívar, Dist. Bambamarca, 2,800 m, *C. Vargas C. 22651* (holotype, CUZ).

Hippeastrum intiflorum (Vargas) Gereau & Brako, comb. nov. Basionym: *Amaryllis intiflora* Vargas, Bol. Fac. Ci. Univ. Nac. Cuzco 1: 2. 1960. TYPE: Peru. Cuzco: Prov. Quispicanchis, Hacienda Cadena, Valle de Marcapata, *C. Vargas C. 12985* (holotype, CUZ).

Hippeastrum leonardii (Vargas) Gereau & Brako, comb. nov. Basionym: *Amaryllis leonardii* Vargas, Herbertia 40: 131. 1984. TYPE: Peru. Puno: Prov. Sandía, San Juan del Oro, *C. Vargas C. 21654* (holotype, CUZ).

Hippeastrum macbridei (Vargas) Gereau & Brako, comb. nov. Basionym: *Amaryllis macbridei* Vargas, Biota 8: 240. 1970. TYPE: Peru. Cuzco: Urubamba (cult. from bulbs collected in Puno, Sandía), 2,840 m, *C. Vargas C. 16422* (holotype, CUZ; isotype, USM).

Hippeastrum variegatum (Vargas) Gereau & Brako, comb. nov. Basionym: *Amaryllis variegata* Vargas, Pl. Life 31: 29. 1975. TYPE: Peru. Puno: Prov. Sandía, near Oconeque, 1,800 m, *C. Vargas C. 16423* (holotype, CUZ).

2. *Ismene* Salisbury

Herbert (1837) recognized *Elisena* Herbert, *Hymenocallis* Salisbury, and *Ismene* as related but separate genera. Baker (1888) maintained *Elisena* at generic rank, but reduced *Ismene* to *Hymenocallis* subg. *Ismene* (Salisbury) Baker. Macbride (1936) simply combined *Elisena* and *Ismene* with *Hymenocallis* with no recognition of subgeneric distinctions. Meerow (1988, 1990) included *Elisena* and *Pseudostenomesson* Velarde in *Ismene*, and despite considerable polymorphism in flower and pollen morphology, he considered the expanded *Ismene* a monophyletic group deserving generic status on the basis of vegetative, ovary, and seed morphology and chromosome number. The following new combinations are needed for species occurring in Peru:

Ismene hawkesii (Vargas) Gereau & Meerow, comb. nov. Basionym: *Hymenocallis hawkesii* Vargas, Pl. Life 31: 27. 1975. TYPE: Peru. Cuzco: Prov. Quispicanchis, Lucre, 3,050 m, *C. Vargas C. 16995* (holotype, CUZ).

Ismene morrisonii (Vargas) Gereau & Meerow, comb. nov. Basionym: *Stenomesson morrisonii* Vargas, Natl. Hort. Mag. 22: 132. 1943. *Pseudostenomesson morrisonii* (Vargas) Velarde, Revista Ci. (Lima) 51: 47. 1949. *Hymenocallis morrisonii* (Vargas) Traub, Pl. Life 21: 96. 1965. TYPE: Peru. Apurímac: Prov. Abancay, gorge of Matará, Hacienda Soccospampa, 2,400–2,800 m, *C. Vargas C. 2281* (holotype, CUZ not seen; isotype, MO).

On the basis of a photo of the plant and a sketch of the flower, Ravenna (1988) rejected Traub's transfer of *Stenomesson morrisonii* to *Hymenocallis*, thereby refuting its affinity with *Ismene* (but without mentioning Velarde's transfer of *S. morrisonii* to *Pseudostenomesson*). Examination of the isotype at MO clearly reveals two basal, globose ovules in each locule of the ovary. Furthermore, the relatively large globose seed (fleshy when fresh) can be observed in a developing capsule on the isotype. The locules of all species of *Stenomesson* have numerous ovules, which are flattened and develop into flat, dry, winged seeds.

Ismene ringens (Ruiz & Pavón) Gereau & Meerow, comb. nov. Basionym: *Pancratium ringens* Ruiz & Pavón, Fl. Peruv. 3: 53. 1802. *Liriope ringens* (Ruiz & Pavón) Herbert, Appendix 42. 1821. *Elisene ringens* (Ruiz & Pavón) Herbert, Amaryllidaceae 201. 1837. *Hymenocallis ringens* (Ruiz & Pavón) J. F. Macbride, Field Mus. Nat. Hist., Bot. Ser. 13(1): 673. 1936. TYPE: Ruiz & Pavón, Fl. Peruv. 3: t. 283, fig. b. 1802 (lectotype, selected here).

Ismene sublimis (Herbert) Gereau & Meerow, comb. nov. Basionym: *Elisena sublimis* Herbert, Bot. Mag. 67: sub pl. 3873. 1841. *Hymenocallis sublimis* (Herbert) J. F. Macbride, Field Mus. Nat. Hist., Bot. Ser. 11: 11. 1931. TYPE: Peru. La Libertad: Cajamarquilla, *Maclean s.n.* (holotype, K).

3. *Leptochiton* Sealy

Sealy (1937) described the genus *Leptochiton* based on a single species, *L. quitoensis* (Herbert) Sealy, an ephemeral geophyte of southwestern Ecuador and adjacent northwestern Peru. Meerow (1990) maintained this genus (as *Lepidochiton*, orth. var.) largely on the basis of ovary and seed morphology. Although we have not yet been able to examine type material, there can be no doubt from the illustration in Ravenna (1980) that the following new combination is needed:

Leptochiton helianthus (Ravenna) Gereau & Meerow, comb. nov. Basionym: *Hymenocallis heliantha* Ravenna, Bot. Not. 133: 97. 1980. TYPE: Peru. Cajamarca: grassy slopes in region of Magdalena, between Pacasmayo and Cajamarca, cult. in Santiago de Chile, *P. Ravenna 2059* (holotype, Herb. Ravenna not seen; isotype, USM not seen).

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A New *Ocotea* (Lauraceae) from the High Mountains of Costa Rica and Panama

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ABSTRACT. *Ocotea pharomachrosorum* (Lauraceae), of the *Ocotea helecterifolia*-group from Costa Rica and Panama, is described here.

Within the large genus *Ocotea* Aublet (Lauraceae), this new species belongs to the *Ocotea helecterifolia*-group. This group contains numerous borderline cases between the genera *Ocotea*, *Nectandra*, and *Phoebe* (Rohwer, 1991; 1992 in litt.). However, its outer tepals are glabrous inside, the inner ones have only a few papillae and the anthers are fleshy and smooth, not papillate, nor hood-shaped; these are all *Ocotea*-like characters. Although this species was collected for the first time several years ago, the material was insufficient to describe it. This collection was treated by Rohwer (1991) as *Ocotea* sp. A and by Burger & van der Werff (1991) as "a species of uncertain position."

Ocotea pharomachrosorum Gómez-Laurito, sp. nov. TYPE: Costa Rica. San José: Dota, San Gerardo, Finca de Efraín Chacón, 10°32′20″N, 83°49′05″W, 2,100–2,200 m, 10 feb. 1992, *J. Gómez-Laurito, J. A. López, A. Mora & W. Barillas 12160* (holotype, CR; isotypes, F, MO, K, USJ). Figure 1.

A speciebus quas Rohwer ad species e turma helecterifolia ascripsit combinatione indumenti densissimi crispati cum basibus foliorum inaequilateralibus et nervis lateralibus utroque 3–5 distinguenda.

Trees 8–12 m tall, 30–40 cm D.B.H., trunk straight, terete; bark grayish with transverse lenticels; inner bark yellowish; wood hard. Leafy branchlets densely grayish tomentulous with curled and matted hairs. Leaves alternate, distant; petioles 2.5–3.5 cm long; lamina 9–19 cm long, 5–7.5 cm broad, narrowly ovate to ovate-elliptic or ovate-oblong, tapering to a short-acuminate apex, obtuse to rounded at the base, the sides of lamina unequal at the base with the sides 2–6 mm distant on the petiole, drying stiffly chartaceous or subcoriaceous, the upper surface glabrous and lustrous but with hairs above the slightly elevated proximal major veins, tertiary venation slightly elevated, lower surface densely yellowish gray or whitish gray tomentulous, the hairs minute (0.1–0.3 mm) and curved, with 3–5 major secondary veins on each side, the basal secondaries often strongly ascending, central secondaries arising at angles of 35°–50°. Young leaves very dense brownish tomentose. Inflorescences solitary and axillary to distal leaves or undeveloped leaves near the shoot tip, paniculate with short lateral branches subtended by conspicuous (4–7 mm) oblong bracts, peduncle, rachis and bracts densely brownish gray tomentulous. Flowers white, delicately scented; 6 tepals 4–5 mm long, 3 mm wide, externally pubescent, internally scarcely papillose; 9 fertile stamens, 6 outer, 3 inner, subsessile, thick, fleshy, smooth with hairs at base of filaments; glands sessile, 0.6 mm long. Ovary ovoid, glabrous. Style 1 mm long; stigma capitate. Cup 8–13 mm long, obconic, red-tinged. Berry ellipsoid, 3.5 cm long, up to 2 cm wide, green to purple at maturity.

This new species and other Lauraceae are an important food source of one of the most beautiful birds in Central America: the resplendent quetzal (*Pharomachros mocinno*), hence the name. *Ocotea pharomachrosorum* is easily distinguished by its dense gray tomentum of branchlets and undersides of leaves; unusual long petioles to 3.5 cm long; subcoriaceous leaves with only 3–4 pairs of major veins and sides of the lamina unequal at the base. Moreover, the young leaves and shoots are conspicuously dense brownish tomentose. It is presently known from the Pacific slope of the Cordillera de Talamanca in Costa Rica, and adjacent Chiriquí highlands in Panama, from 1,600 to ca. 2,300 m elevation.

Paratypes. Same locality as type: *Julio Sánchez s.n.* (CR, USJ). PANAMA. CHIRIQUI. Vic. of Boquete, Finca Collins, El Velo, 12 Mar. 1963 (US) *Stearn et al. 1985.*

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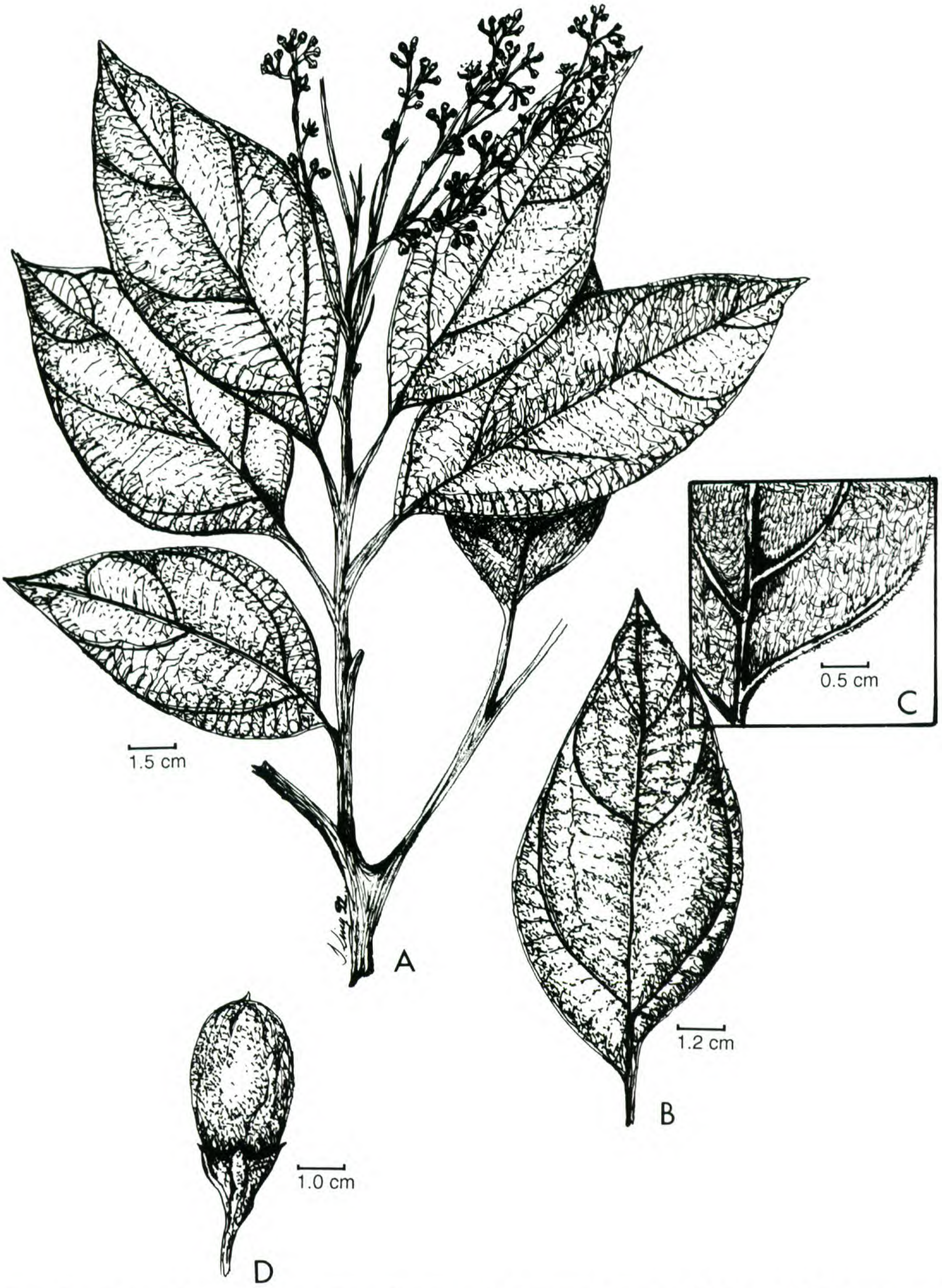

Figure 1. *Ocotea pharomachrosorum* Gómez-Laurito. —A. Flowering branch. —B. Leaf. —C. Leaf base. —D. Fruit. Drawing by Ileana Ling.

script, and Julio Sánchez (Museo Nacional de Costa Rica) who brought the type locality to my attention.

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A Synopsis of the Panamanian Species of *Ilex* (Aquifoliaceae)

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ABSTRACT. The species of *Ilex* (Aquifoliaceae) native to Panama are treated in a synoptic fashion. Three new species are described: *Ilex fortunensis*, *Ilex maxima*, and *Ilex stellata*.

The *Flora of Panama* (Edwin, 1968) listed four species of *Ilex* for the country, based on only 17 specimens. One-half of these specimens were of the widespread *Ilex guianensis* (Aublet) Kuntze collected in the Pearl Islands. An increase in collecting activity over the past 20 years, especially in the moist uplands of Chiriquí, Coclé, and Bocas del Toro. Panama, has produced a current collection base of over 200 specimens representing 10 species of *Ilex*, including three previously undescribed.

Similar changes in estimates of local species diversity for the genus based on new collections occur elsewhere in the Neotropics. For example, extensive collecting in the Guayana Highlands since the 1950s has increased recorded diversity from 6 species of *Ilex* (Wurdack, 1961) to 55 species (Edwin, 1965) to 78 species (Steyermark, 1988). The typological species concepts employed by the latter two authors probably overstate diversity for the Guayana Highlands. The pattern of increase in recorded diversity is indisputable, however, and strongly suggests the need for additional collecting.

In Panama, three main groupings of species can be made based on the nature of the inflorescence-bearing shoots. One group, composed of *Ilex costaricensis* J. D. Smith and *I. pallida* Standley, bears solitary, axillary inflorescences in both flower and fruit. This is equivalent to the solitary flowering unit composed of secondary dichasia sensu Loizeau (1992: figs. 2h, 13). These two species differ from each other in a number of characters and are not closely related.

In the second group the inflorescence-bearing shoots are short while in flower (= brachyblasts), but usually expand and develop normal leaves toward the apex as the fruits mature. In the terminology of Loizeau (1992: figs. 2g, 11, 12), these are proliferating thyrses. This group consists of four species in Panama: *I. stellata* W. J. Hahn, *I. fortunensis* W. J. Hahn, *Ilex lamprophylla* Standley, and *I. guianensis*, which may be loosely related to each other. The first two taxa are endemic to Panama and are known from only a few collections. *Ilex lamprophylla* is largely restricted to Panama and Costa Rica, with a few isolated populations in Nicaragua. Related species are found in northern South America. *Ilex guianensis* is the most widespread member of a large species group centered in northern South America (Hahn, 1988).

A third group of species includes *I. vulcanicola* Standley, *I. chiriquensis* Standley, *I. yurumanguinis* Cuatrecasas, and *I. maxima* W. J. Hahn. These species are characterized by abaxial leaf punctations and inflorescences borne on brachyblasts in both flower and fruit. The basic inflorescence unit is still a cyme, but the stem that bears the cymes fails to elongate as in the previous group and never bears leaves. The overall appearance of the cluster of cymes is umbellate or paniculate which corresponds to the non-proliferating thyrse of Loizeau (1992: fig. 10). The species form part of a natural group probably referable to Loesener's series *Paltoria*. This group of closely related species forms several grades that show broad continua of character states in leaf size and shape, inflorescence size and branching, and fruit size. Several collections show intermediate combinations of character states, making species identification difficult (see notes under *I. chiriquensis* and *I. yurumanguinis*). As most species in this group are South American in distribution, a revision of the group in its main range will be necessary before the identities and relationships of the Panamanian taxa are completely resolved.

Edwin (1968) reported *I. macfaydenii* (Walper) Rehder as possibly occurring in Panama, but this species is restricted to the Greater and Lesser Antilles and possibly Mexico. It is distinguished by thin leaves with long-acuminate apices, distinctly serrate leaf margins, and generally solitary inflorescences.

KEY TO THE SPECIES OF *ILEX* IN PANAMA

1a. Leaves epunctate abaxially; individual cymes solitary in the leaf axils when in fruit.
  2a. Leaf margin entire or essentially so.

3a. Leaves coriaceous, moderately to faintly discolorous, glaucous, glabrous or with a few scattered hairs, the margins revolute, secondary veins obscure to apparent; pistillate cyme branched or unbranched, peduncles 1–2 mm diam.; fruits 3–7 mm long, 2.5–7 mm diam.
4a. Leaves elliptic, drying dark brown or black abaxially, the margin revolute, strongly so at the base, venation brochidodromous, secondary veins apparent; cymes solitary in the leaf axils when in flower and in fruit; pistillate flowers 3–7 per dichasium (sometimes solitary at high elevations); fruits 3–7 mm long, 2.5–5.5 mm diam. ..... 1. *Ilex costaricensis* J. D. Smith
4b. Leaves usually spatulate or obovate, drying olive green or brown abaxially, the margin revolute but not at the base, venation semicraspedodromous, secondary veins obscure; cymes clustered on brachyblasts when in flower, usually solitary when in fruit; pistillate flowers solitary; fruits 4.5–6 mm long, 4–7 mm diam. ..... 2. *Ilex guianensis* (Aublet) Kuntze
3b. Leaves chartaceous to thin coriaceous, strongly discolorous, puberulent, the margin flat, secondary veins distinct; pistillate inflorescence branched, peduncles 2–3 mm diam.; fruits 0.9–1.1 cm long, 0.7–1 cm diam. ..... 3. *Ilex fortunensis* W. J. Hahn
2b. Leaf margin toothed or crenulate, sometimes minutely so, the teeth bearing small marginal spines.
5a. Leaves planar, elliptic to ovate or obovate, 3–6 cm long, 1.5–3 cm wide, glabrous or pubescent with simple hairs.
6a. Leaves drying pale green or olive, margin serrate-dentate, petiole 2–5 mm long; cymes solitary in flower and fruit; fruits 6–10 mm long, 4–8 mm diam. ..... 4. *Ilex pallida* Standley
6b. Leaves frequently drying dark brown or black, margin crenulate or serrate to almost entire, petiole 3–45 mm long; cymes clustered or solitary in flower, usually solitary in fruit; fruits 3–6 mm long, 3–4 mm diam.
7a. Leaf margin usually distinctly crenulate, flat; petiole 3–8 mm long; cymes clustered on brachyblasts in flower; pistillate flowers solitary; pericarp thin, fruit usually deeply ribbed when dry ..... 5. *Ilex lamprophylla* Standley
7b. Leaf margin mostly entire, a few spines occasionally present, never crenulate, revolute, strongly so at the base and abaxially along the petiole; petiole 8–45 mm long; cymes solitary in the leaf axils when in flower; pistillate flowers solitary or more frequently 3–7 per dichasium; pericarp leathery, fruit surface smooth when dry ..... 1. *Ilex costaricensis* J. D. Smith
5b. Leaves deeply to shallowly bullate, broad elliptic to rotund, 5–10 cm long, 3–8 cm wide, bearing deciduous stellate hairs ..... 6. *Ilex stellata* W. J. Hahn
1b. Leaves with conspicuous glandular punctations abaxially; cymes in flower and fruit borne clustered on brachyblasts.
8a. Leaves coriaceous, 1.5–10 cm long, orbicular to elliptic or obovate, secondary venation usually obscure; staminate cymes unbranched.
9a. Leaves 1.5–3 cm long; 5–10 cymes per fascicle; fruits 2.5–4 mm long ..7. *I. vulcanicola* Standley
9b. Leaves 3–10 cm long; 5–20 cymes per fascicle; fruits 4–7 mm long ... 8. *I. chiriquensis* Standley
8b. Leaves chartaceous to coriaceous, (6–)8–40 cm long, elliptic, secondary venation distinct; staminate cymes branched.
10a. Leaves (6–)8–13 cm long, 4–7.5 cm wide with 6–8 secondary veins per side; fruit 0.3–0.6 cm long ..... 9. *I. yurumanguinis* Cuatrecasas
10b. Leaves 15–40 cm long, 10–13 cm wide, with 10–15 secondary veins per side; fruit 0.8–1 cm long ..... 10. *I. maxima* W. J. Hahn

1. Ilex costaricensis J. D. Smith, Bot. Gaz. (Crawfordsville) 57: 416. 1914. TYPE: Costa Rica. Puntarenas: Cuesta de la Cara, haud procul ab El Páramo, *Pittier 10183* (erroneously cited as *Pittier 10843* in original publication) (holotype, US 1380596).

Ilex valerii Standley, J. Wash. Acad. Sci. 16: 483. 1926. TYPE: Costa Rica. Heredia: Cerros de Zurquí, NE of San Isidro de Las Vueltas, *Standley & Valerio 50582* (holotype, US 1251513; isotype, K).

Ilex brenesii Standley, Field Mus. Nat. Hist., Bot. Ser. 18: 629. 1937. TYPE: Costa Rica. Entre La Palma y El Socorro de San Ramón, *Brenes 6226* (holotype, F).

Ilex ramonensis Standley, Field Mus. Nat. Hist., Bot. Ser. 18: 630. 1937. TYPE: Costa Rica. Entre Pata de Gallo y Santiago de San Ramón, *Brenes 6639* (holotype, F).

Ilex costaricensis is known throughout the Talamancas of western Panama and eastern Costa Rica through the Cordillera Central of Costa Rica and on Volcán Mombacho in Nicaragua. In Panama, the species occurs at elevations of 1,200–1,700 m; flowering mostly in August.

Distinctive characters of *Ilex costaricensis* include epunctate leaves, attenuate leaf bases, leaf margins entire and strongly revolute at the base and along the petiole, the blade drying black or dark brown, lenticellate stems drying dark brown to black, inflorescences solitary and axillary, and capitate stigmas prominent in flower and fruit.

Edwin (1968) treated *Ilex valerii* from Costa Rica as a distinct species and included *I. ramonensis* Standley as a variety. *Ilex costaricensis* was apparently overlooked by Edwin, as he failed to mention the taxon in his treatment. The similarities between the types of these three taxa are numerous

and clearly support recognition of a single species. The type specimen of *Ilex brenesii* (*Brenes 6266*) is extreme in petiole, peduncle, and pedicel lengths, which are 3–10 times that found on other specimens of *Ilex costaricensis*. However, all other characteristics of the specimen agree with the type of *Ilex costaricensis* and fall within the range of variation accepted for that species. Smith (1914) placed *Ilex costaricensis* close to *I. mexicana* Hemsley based on apparent similarities in the inflorescences.

Collections from Cerro Colorado, Chiriquí, on the Continental Divide (*Folsom et al. 4755*, *McPherson 8807*, and *Mori & Dressler 7895*) have smaller, thinner, narrowly elliptic to lanceolate leaves with the margin revolute at the base and along the portion attenuate to the petioles. Occasionally a few spines are present on the leaves. These differences are consistent among all collections from Cerro Colorado and are perhaps related to local environmental conditions, such as the high copper concentrations of the substrate. The specimen from Cerro Hornito (*Croat 67961*) is similar to the type, however, and to most Costa Rican material.

Additional specimens examined. PANAMA. BOCAS DEL TORO: Cerro Colorado, *McPherson 8807* (MO, PMA). CHIRIQUI: Cerro Hornito, *Croat 67961* (G, MO); Cerro Colorado, *Folsom et al. 4755* (K, MO, PMA); Cerro Colorado, *Mori & Dressler 7895* (F, MO, NY, PMA, US, NY).

2. Ilex guianensis (Aublet) Kuntze, Rev. Gen. Pl. 1: 113. 1891. *Macoucoua guianensis* Aublet, Hist. Pl. Gui. Fr. 88, t. 34. 1775. *Ilex acuminata* Willdenow, Sp. Pl. 1: 711. 1798. *Ilex macoucoua* Persoon, Syn. Pl. 1: 152. 1805. TYPE: French Guiana, *Aublet s.n.* (holotype, P in herb. Rousseau, vol. 3, folio 100). Figure 1.

Ilex panamensis Standley, Field Mus. Nat. Hist., Bot. Ser. 4: 221. 1952. TYPE: Panama. Bocas del Toro: *Cooper 469* (holotype, F 579403; isotype, K).

Ilex gentlei Lundell, Field & Laboratory 13: 5. 1945. TYPE: Belize. Toledo, Punta Gorda–San Antonio Road, *Gentle 4807* (holotype, SMU not seen; photo, MO; isotype, K).

Although somewhat variable, this species is characterized by its epunctate, coriaceous, spatulate to obovate leaves with entire, revolute margins and obscure secondary venation. While in flower, the cymes are borne on brachyblasts, which later expand as fruits mature resulting in clearly lateral or axillary cymes.

Of the species native to Panama, *Ilex guianensis* has the widest distribution, ranging from the Guianas through Venezuela and Colombia along the Caribbean coast of Central America to Tobasco, Mexico, and apparently throughout the Greater Antilles (Bornstein, 1989). It is also a major component of the vegetation of the Pearl Islands off the Pacific Coast of Panama (Johnston, 1949), illustrative of the numerous Caribbean species found on these islands (Bennet, 1968; D'Arcy, 1977). Flowering in Panama occurs during the major dry season of December to April, with scattered occurrence at other times of the year, particularly for upland populations.

Closely related congeners forming Loesener's section *Micranthae* subsect. *Epunctatae* are among the most variable and widespread within the genus (Bornstein, 1989). Previous studies of this group include a discussion of the relationships between *I. guianensis* and the widespread Caribbean taxon *Ilex sideroxyloides* (Swartz) Grisebach (Bornstein, 1989), and a limited study of the group as found in northern Central America (Hahn, 1988). Further study of the limits of variation in this group of species, particularly in the Greater Antilles and in northern South America, would help in establishing species delimitations and relationships. In the present work, the species is treated as known from Central America and the Guianas; synonymy is limited to Central America.

The presumably natural habitat for *I. guianensis* is sclerophyllous forest on seasonally dry, coastal or inland savannas typical of the type localities of Cayenne and Sinamarry, French Guiana, cited by Aublet. A similar sclerophyllous habitat with strong Caribbean affinities is also seen in the Pearl Islands, where most collections of the species in Panama have been made. The greatest degree of intraspecific variation, however, typically arises in recently disturbed areas at higher elevations. Such middle-elevation populations in Panama are known from Cerro Jefe, Cerro Campana, Cerro Azul, Boquete, and El Valle de Anton, all zones of deforestation within the last few hundred years (Bennet, 1968; D'Arcy, 1977).

A number of other species closely related to *Ilex guianensis* have been described from Colombia (e.g., *I. uniflora* Bentham and *I. danielis* Killip & Cuatrecasas), which may represent high-elevation morphs as found in Panama. *Ilex guianensis* is apparently replaced in the Amazon Basin by the related *I. inundata* Poeppig.

Reports of *Ilex occidentalis* Macfayden from Ancon Hill (Hemsley, 1880; see also Standley, 1929), based on *Seemann 554*, and *Ilex bumelioides* Kunth (Hemsley, 1880), based on *Duchassaing s.n.*, were founded on erroneous species concepts held by these authors (see Triana, 1872; Loesener, 1901), as

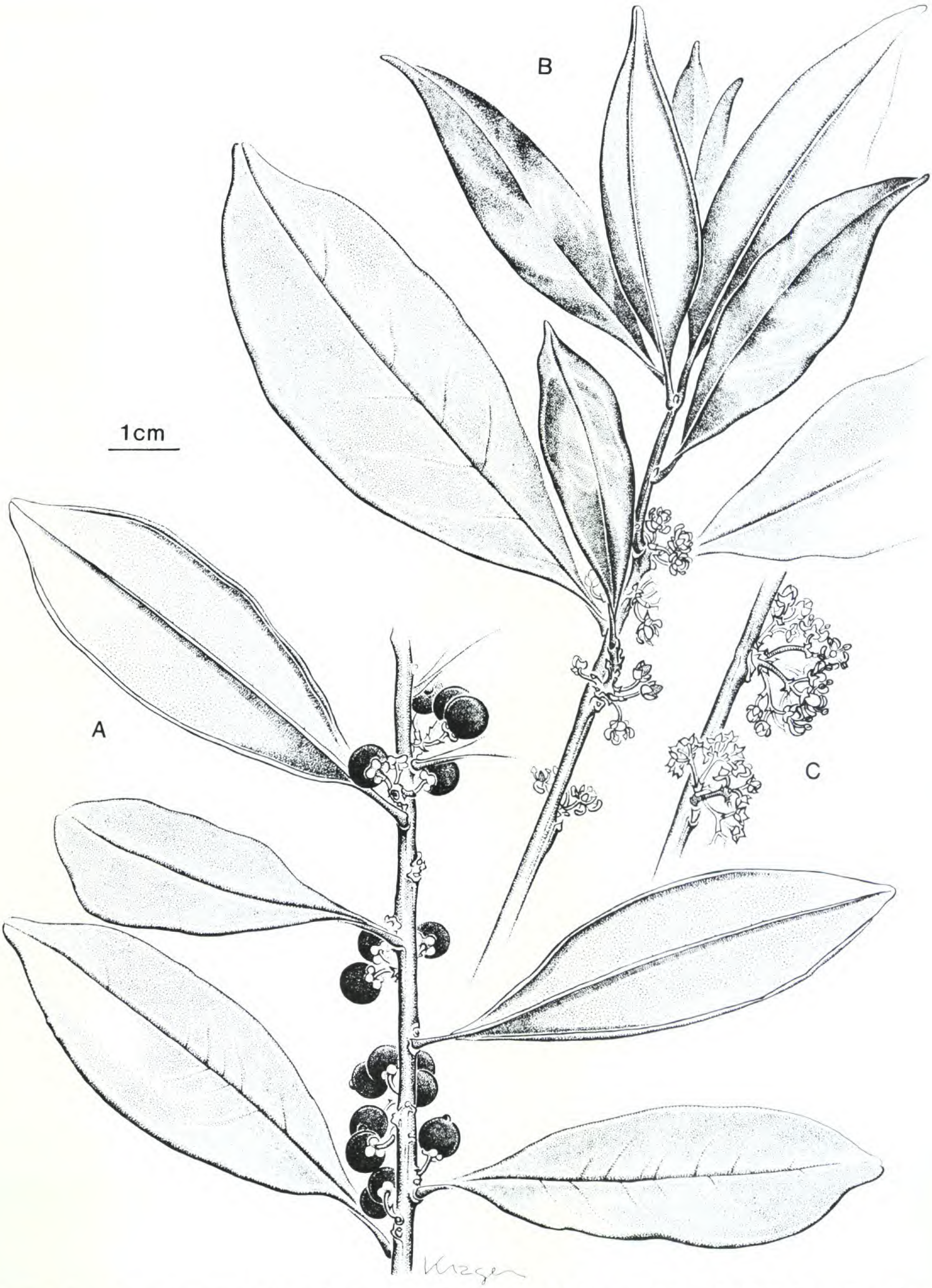

Figure 1. *Ilex guianensis* (Aublet) Kuntze. —A. Habit in fruit (*Johnston 224*). —B. Habit in pistillate flower (*Gentle 1244*). —C. Habit in staminate flower (*Erlanson 411*).

these collections clearly represent *Ilex guianensis*. The type of *Ilex bumelioides* Kunth is from Ecuador; the species is more closely related to *I. kunthiana*, while *Ilex occidentalis* Macfayden of Jamaica is probably synonymous with *I. guianensis*.

Additional specimens examined. PANAMA. BOCAS DEL TORO: Almirante, Bocas Island, *Cooper 469* (F, G, K, NY); Chiriquí Lagoon, *von Wedel 1144* (GH, MO). CHIRIQUI: Llanos Francia, *Dwyer & Lallathin 8698* (MO, NY); El Boquete, Holcomb's Trail, *Killip 3562a* (US); Boquete, Llanos Francia, *Stern et al. 1197* (GH, MO). COCLE: El Valle, *Allen 752* (GH, MO); hills S of El Valle de Anton, *Allen 2505* (MO, NY, US), *Allen 3570* (F, G, GH, K, MO, NY, P, US); Penonome, *Dwyer 2017* (MO); between El Cope and sawmill on Continental Divide, *Hammel 2645* (MO, NY). COLON: along ocean trail between Río Indio and Miquel de la Borda, *Croat 36916* (MO), *Croat 36920* (MO); Salud, *Lao & Holdridge 229* (MO); trail above Río Indios, *Sullivan 113* (MO). HERERRA: 10 km W of Las Minas on road to El Toro, *D'Arcy & Sytsma 14319* (MO), *Sytsma & D'Arcy 3245* (MO); Las Minas, *Stern et al. 1807* (MO). LOS SANTOS: road to El Cortezo, *D'Arcy & Sytsma 14356* (MO, NY). PANAMA: Cerro Jefe, *Churchill 4284* (BM, G, MEXU, MO, PMA), *D'Arcy et al. 15500* (G, MEXU, MO, PMA) *D'Arcy et al. 15506* (G, MEXU, MO, PMA); ibique in monte Lancon iuxta urbem ipsem, *Duchassaing s.n.* (A); Cerro Campana, *Duke 10724 (3)* (MO, OSU); Isla del Rey, *Duke 9519* (MO); Cerro Azul, *Dwyer 4087* (MO), *Dwyer 4700* (MO); San José Island, *Erlanson 77* (G, GH, NY, US), *Erlanson 260* (G, P, US), *Erlanson 348* (G, GH, NY, US), *Erlanson 411* (GH, US), *Erlanson 513* (GH, US); Cerro Jefe, *Folsom et al. 2516* (MO, PMA); Cerro Azul, *Gentry & Dwyer 3408* (DUKE, F, NY); San José Island, *Harlow 95* (GH, US), *Johnston 224* (DUKE, GH, US), *Johnston 338* (GH), *Johnston 341* (BM, GH, MO, US), *Johnston 426* (GH, MO, US), *Johnston 428* (DUKE, GH); Cerro Jefe, *Mori 6529* (MO), *Mori 6531* (MO, NY), *Pipoly 7018* (MO); without locality (cited in Hemsley (1879) as Mount Lancon (Ancon Hill), near the city of Panamá) *Seemann 554* (K); Cerro Campana, *van der Werff & Herrera 6153* (DUKE, G, K, MEXU, MO, NY, PMA), *van der Werff & van Hardeveld 6916* (MEXU, MO, PMA); Playa Corona, *Vargas, Jr. 15* (MO). VERAGUAS: Escuela Agrícola Alto de Piedra, *Croat & Folsom 33978* (MO).

3. Ilex fortunensis W. J. Hahn, sp. nov. TYPE: Panama. Chiriquí: La Fortuna hydroelectric project, in cloud forest, along trail uphill behind camp, 1,200–1,400 m, *Hammel 2164* (holotype, MO 3488625; isotypes, PMA, US).

Frutex; caules lenticellis praediti; folia integra, tenuicoriacea, glabra, valde bicoloria, epunctata; inflorescentiae pistillatae ramosae 2 ordene dispositae; stigma quadrilobatum; fructus globosi, 9–10 mm × 7–10 mm.

Shrub, 4 m tall, moderately branched. Stems terete, somewhat ridged when young, covered with fine white pubescence, young stems drying dark brown or black; lenticels small and sparse or absent; bark dark gray-brown, smooth to somewhat rough with numerous round or oval lenticels, 1–2 mm diam.; stipules broad-triangular, 0.4–0.8 mm long, 0.8–1.4 mm wide, deciduous. Leaves thin coriaceous, glabrous, drying dark olive green adaxially, pale yellowish tan abaxially, epunctate, elliptic to obovate-elliptic, (5–)7–9(–11) cm long, 3.5–5 cm wide, apex caudate to acute, base shortly attenuate, margins entire, sometimes very slightly revolute; venation brochidodromous, somewhat eucamptodromous at the base, the secondary veins 5–7 per side, the tertiary veins reticulate, apparent; petioles 0.5–1 cm long, 0.8–1.2 mm diam., round in cross section, caniculate adaxially, drying black. Staminate inflorescences not known. Pistillate inflorescences not known in flower, only in fruit where they are axillary or lateral simple cymes on new wood, branched to 2 orders with 3 fruits per inflorescence; bracts ovate-triangular, ca. 2 mm long, thick coriaceous; peduncles 0.5–1 cm long, 1–1.5 mm wide, flat in cross section, tapering toward the apex; peduncular bracts triangular, 0.5–0.8 mm long, 0.8–1 mm wide, paired laterally at the first furcation; pedicels 2–5 mm long, square or angled in cross section; bracteole absent. Fruit globose, 9–11 mm long, 7–10 mm diam.; sepals 4–5, oblong or rounded; pericarp coriaceous, 0.3–0.5 mm thick, deep red to purple drying black-purple, the stigma four-lobed, 3.5–4.5 mm diam., spreading, not prominent in profile; mesocarp copious; immature pyrenes 4, trigonal.

Ilex fortunensis is known only from the type collection from the La Fortuna hydroelectric site in Chiriquí at an elevation of 1,200–1,400 m. This collection bears immature fruits collected in March.

The species is distinguished by the inflorescence type and the distinctly discolorous, thin coriaceous leaves with entire margins. The infructescences are borne on relatively young stems, suggesting that the inflorescences were clustered on an abbreviated stem while flowering.

4. Ilex pallida Standley, J. Wash. Acad. Sci. 16(18): 482. 1926. TYPE: Costa Rica. Heredia: Cerros de Zurquí, NE of San Isidro, 2,300 m, *Standley & Valerio 50608* (holotype, US 1251651; isotype, F). Figure 2.

Ilex pallida is found throughout the Talamancas of Panama and Costa Rica and on nearby mountains at 2,000–3,000 m, and on Volcán Mombacho in Nicaragua above 1,100 m. The species flowers late in the Panamanian dry season, February to April, and again during the brief intermittent dry spell of June to August. Fruits are borne in March and September in Panama and Costa Rica, more sporadically in Nicaragua.

The species is characterized by the epunctate leaves, consistently spinose margins with small but

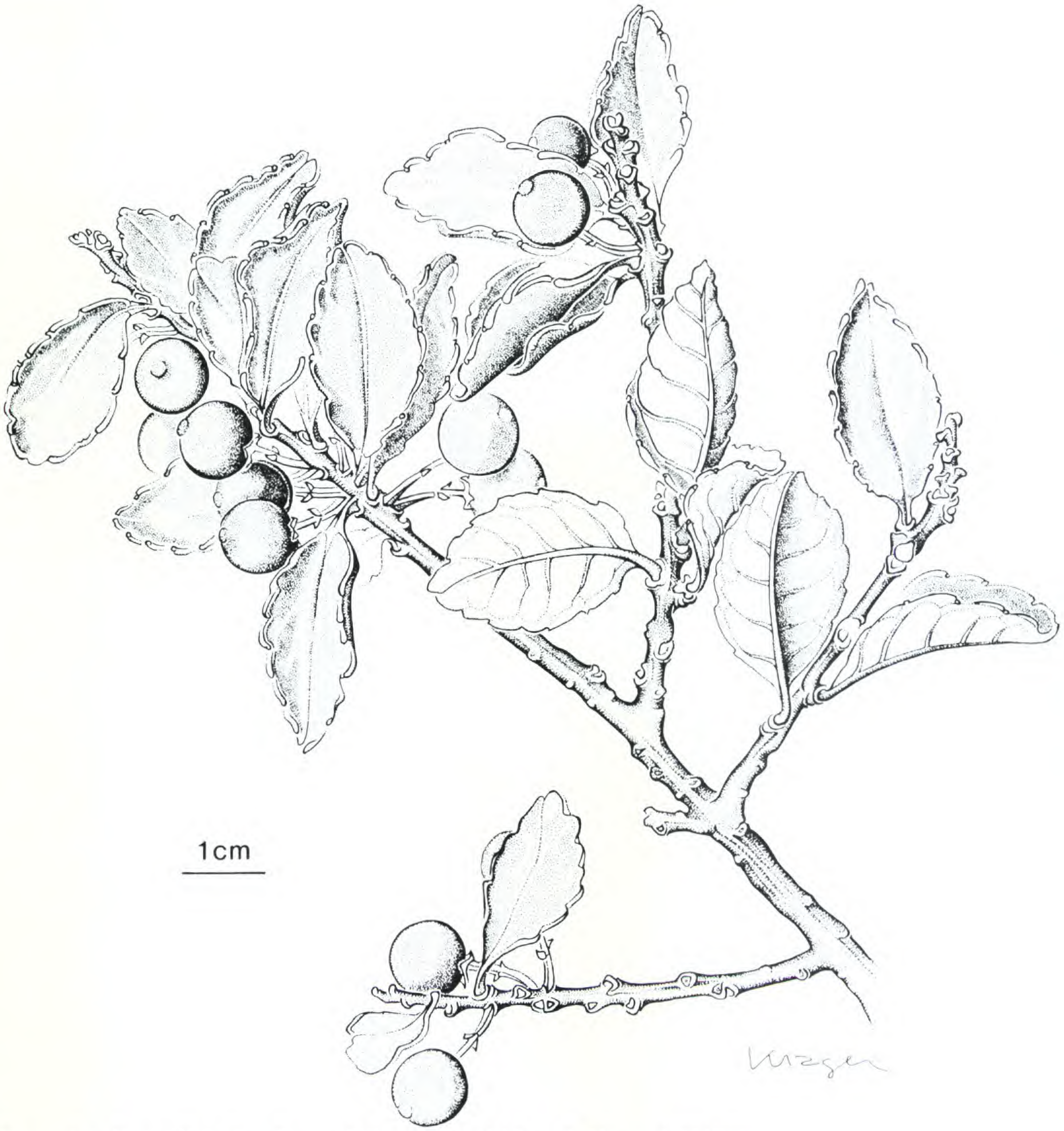

Figure 2. *Ilex pallida* Standley. —Habit in fruit (*D'Arcy & Hammel 12496*).

evident serrations or crenulations, the blade drying green or olive, pistillate inflorescences with solitary flowers and fruits, and the fruits to 1 cm long and 0.8 cm in diameter. Most collections from the Talamancas have relatively thin leaves.

Additional specimens examined. PANAMA. BOCAS DEL TORO: Valle de Silencio, *Antonio 1599* (G, K, MO, PMA); 6 km NW of Cerro Enchandi, *Davidse et al. 25237* (CR, G, MO). CHIRIQUI: El Volcán, *D'Arcy & Hammel 12496* (MO, PMA, US); Bajo Chorro, *Davidson 254* (F, MO); Volcán Baru, *Hammel et al. 6446* (PMA); Aguacata, *Hammel et al. 7019* (A, F, MO, NY, PMA); Bajo Chorro, *Wilbur et al. 17276* (DUKE).

5. Ilex lamprophylla Standley, J. Wash. Acad. Sci. 15(21): 476. 1925. *Ilex discolor* Hemsley var. *lamprophylla* (Standley) Edwin, Ann. Missouri Bot. Gard. 53: 376. 1966. TYPE: Costa Rica. Cartago: La Estrella, *Standley 39440* (holotype, US 1228657; isotypes, A, K). Figure 3.

Ilex carpinterae Standley, J. Wash. Acad. Sci. 15(21): 477. 1925. TYPE: Costa Rica. Cartago: Cerro de La Carpintera, *Standley 34491* (holotype, US 1226682).

Ilex tristis Standley, J. Wash. Acad. Sci. 16(18): 482. 1926. TYPE: Costa Rica. San José: Cerro de las Vueltas, *Standley & Valerio 43670* (holotype, US 1251406).

Ilex davidsoniae Standley, Field Mus. Nat. Hist., Bot. Ser. 22: 88. 1940. TYPE: Panama. Chiriquí: Bajo Chorro, Boquete District, *Davidson 166* (holotype, F 915592; isotypes, A, MO, US).

Figure 3. *Ilex lamprophylla* Standley. —A. Habit in fruit (*Standley 39440*). —B. Fruits (*Standley 39440*).

Usually found above 1,500 m elevation, this species is particularly abundant in the Cordillera Central of Costa Rica, with extensions into the Talamancas of Costa Rica and Panama and on scattered peaks in Nicaragua and El Salvador. Flowering in Panama occurs at the end of the wet season through the dry season, September to March.

Ilex lamprophylla is readily recognized by its

normally rounded leaf crenulations, epunctate leaves, which frequently dry a dark brown color, lighter brown abaxially, cymes on a reduced stem, which later expands in fruit, and the deeply grooved pyrenes, which give a ribbed appearance to the mature fruits.

Ilex davidsoniae and *Ilex carpinterae* were considered by Standley to be possibly synonymous with *I. lamprophylla*. Study of a large array of specimens supports this view. Standley (1926, 1937) also expressed doubts about the validity of his *Ilex tristis*, which he cited as known only from the type locality of Cerro de las Vueltas, San José Province, Costa Rica. A search for this taxon in the region proved fruitless, and I consider it to be merely an immature specimen of *I. lamprophylla*.

Edwin (1968) recognized *I. lamprophylla* as a variety of the Mexican *I. discolor*, citing *I. carpinterae* and *I. davidsoniae* as synonyms. In addition, a number of herbarium specimens from Central America have been annotated by Edwin with *I. discolor* Hemsley var. *tristis* (Standley) Edwin, and *I. discolor* Hemsley var. *hondurensis* (Standley) Edwin. No reasons were given for this transfer, although there is some gross similarity in leaf shape and inflorescence arrangement. *Ilex lamprophylla* differs from *I. discolor* in its thinner, broader, epunctate leaves that dry a dark brown or black, the nature of the brachyblast, the branching and size dimensions of the inflorescence, and in the texture of the fruits and pyrenes.

Two collections from Chiriquí, *McPherson 8946* and *Mori & Kallunki 6000*, are unusual in that the leaves, apparently immature, are relatively thin with much reduced crenulations and a few small marginal spines.

Additional specimens examined. PANAMA. CHIRIQUI: Cerro Punta, *Lao 332* (MO), *Luteyn 3085* (DUKE); Bajo Chorro, *Davidson 166* (A, F, MO, US,); N of San Felix, *Mori & Kallunki 6000* (MEXU, MO, PMA); Fortuna Dam, *McPherson 9095* (MEXU, MO, PMA); Cerro Colorado, *McPherson 8946* (MEXU, MO, PMA). COCLE: El Valle, *Sytsma 3824* (MO, PMA).

6. Ilex stellata W. J. Hahn, sp. nov. TYPE: Panama. Veraguas: vicinity of Cerro Arizona–Tute, above Sante Fé and Altos de Piedra, *McPherson 12806* (holotype, MO 3821597; isotypes: G, K, PMA, WIS).

Arbor; folia bullata tomentosa pilis tomentosis, epunctatis, 5–9 cm longa, 3–5 cm lata; petioli 1–2 cm longi; inflorescentiae pistillatae ramosae; stigma manifeste elevato-capitatum.

Tree to 8 m tall; moderately ramified. Stems slightly ridged on new growth, equally so on older growth, lightly beset with fine tan or white stellate and simple hairs, drying yellowish tan or greenish brown; lenticels scattered, raised, oval, ca. 1 mm long; bark dark grayish to grayish brown, moderate, ridged, densely covered with raised oval lenticels to 1 mm long; stipules triangular, ca. 1 mm long, extensions of the bark. Leaves coriaceous, strongly and deeply bullate, densely pubescent with short, white, stellate hairs, becoming glabrous with age except along the veins abaxially and on the petiole, drying brown to dark brown, epunctate, ovate to obovate, 5–9 cm long, 3–5 cm wide, apex rounded to obtuse, slightly acuminate, base obtuse, short attenuate, margin strongly revolute, essentially entire but with numerous minute teeth along the margin, scarcely visible; venation brochidodromous, the secondary veins 5–7 per side, deeply sunken adaxially, prominent and raised abaxially, the tertiary veins reticulate and distinct; petioles 1–2 cm long, 1–2 mm wide, densely covered with short, white, stellate hairs. Staminate inflorescence not seen. Pistillate inflorescence not seen in flower, in fruit of solitary axillary cymes borne on new wood, branched to 2 or 3 orders with 3–7 flowers per dichasium; bracts ca. 1 mm long, triangular, deciduous; peduncle 5–10 mm long, 1–2 mm wide, flat in cross section; peduncular bract triangular, awl-shaped, ca. 1 mm wide and long, laterally paired or slightly offset at the first furcation; rachis 0.2–1 cm long, 1–1.5 mm wide, flattened or angular; bracteoles 0.5 mm long; pedicels 2–8 mm long, ca. 1 mm wide, angular, tapering toward the base; floral bracteoles apparently absent. Immature fruits depressed globular; sepals 5, explanate in fruit, rounded to ovate, 1–1.5 mm long; pericarp leathery, green, the stigma prominent, raised; mature pyrenes unknown.

The species is endemic to Panama and known only from elfin or summit forest at 1,000–1,200 m elevation on Cerros Caracoral and Gaital in Coclé and Cerros Arizona and Tute in Veraguas Province.

Ilex stellata is readily recognized by the deeply bullate leaves, which bear a moderately thick covering of stellate hairs. *Ilex bullata* Cuatrecasas, described from Valle, Colombia, resembles *I. stellata* with its deeply bullate leaves, but differs in possessing simple hairs, smaller leaves (3–6 cm long, 1.5–3 cm wide) with abaxial punctations, shorter petioles (3–5 mm long), unbranched pistillate inflorescences, and an adpressed capitate stigma. The infructescences are borne solitary and axillary on young stems, suggesting that the cymes are clustered in flower as with *I. lamprophylla*.

Paratypes. PANAMA. COCLE: Cerro Caracoral, *Kirk-*

bride, Jr. 1110 (MO); above El Valle, on trail to top of Cerro Gaital, *McPherson 11958* (F, K, MO, PMA, US).

7. Ilex vulcanicola Standley, J. Wash. Acad. Sci. 15(21): 477. 1925. TYPE: Costa Rica. San José: Las Nubes, *Standley 38729* (holotype, US 1228373).

Ilex vulcanicola is restricted to the highlands of western Panama and Costa Rica at elevations above 1,800 m. This species is related to the widespread, polymorphic *Ilex kunthiana* Triana of Colombia, which differs in having solitary cymes as opposed to the consistently clustered cymes found in *I. vulcanicola*. Other species described from northern South America, such as *I. farrolensis* Cuatrecasas and *I. caniensis* MacBride, are also closely related and together would probably be referable to series *Paltoria* sensu Loesener (1901, 1908). Individuals with extremely large leaves might be confused with *I. chiriquensis*, which differs in its generally larger leaves and fruits and in having more cymes per fascicle. In Panama, flowering of *I. vulcanicola* is sporadic from February to August.

Additional specimens examined. PANAMA. BOCAS DEL TORO: Fortuna Dam, *McPherson 11079* (MO, PMA, US). CHIRIQUI: between Gualaca and Fortuna Dam, *Croat 49956* (MO, NY, PMA, US); La Fortuna, *Hammel 6243* (F, MO, NY, US); between Los Planos de Hornito and Fortuna Dam, *Hampshire & Whitefoord 251* (BM), *Hampshire & Whitefoord 258* (BM). COCLE: Cerro Pilon, *Dwyer & Lallithin 8646* (F, MO, NY); Cerro Gaital, *Knapp et al. 5990* (G, MO, PMA, MEXU); La Mesa, *McPherson 11253* (MO, PMA, US); Cerro Caracoral, *Sytsma 4049* (A, MO, NY, PMA, US). PANAMA: Cerro Campana, *Croat 35973* (F, MO); Cerro Jefe, *Mori & Kallunki 6088* (MO); Cerro Campana, *Mori & Bolten 7694* (F, MO, NY, OSU, US); Cerro Jefe, *Tyson et al. 4362* (F, MO). VERAGUAS: Cerro Tute, *Mori et al. 7594* (A, F, MO, NY, PMA), *Sytsma & Andersson 4691* (A, F, MO, US).

8. Ilex chiriquensis Standley, Pub. Field Mus. Nat. His., Bot. Ser. 22: 88. 1940. TYPE: Panama. Chiriquí: Bajo Chorro, Boquete District, 1,800 m, *Davidson 243* (holotype, F 915550; isotypes, MO, US).

Ilex chiriquensis is largely confined to western Panama and Costa Rica, with outlying populations known at the Monteverde area of western Costa Rica. Populations in Panama are typically found at elevations of 1,500–2,000 m. Collections from the Fortuna Dam area are known from ca. 1,100 m and from Monteverde, Costa Rica, from 2,000 to 2,500 m. The flowering period of *I. chiriquensis* is in March and April, with fruiting from May to August.

This species is distinguished by its medium-sized, thickly coriaceous, orbicular to elliptic leaves, unbranched staminate inflorescences, and depressed capitate fruit. It is sometimes difficult to separate from *Ilex yurumanguinis* but that species typically occurs at lower elevations and has thinner, larger, elliptic leaves with distinct secondary venation, branched staminate inflorescences, and ovoid-capitate fruits. Populations of *I. chiriquensis* from Monteverde, Costa Rica, have relatively distinct secondary venation and more pronounced marginal teeth. An undescribed epiphytic taxon from Costa Rica appears to be closely related to *I. chiriquensis*, but differs in its consistently narrower, obovate leaves.

Additional specimens examined. PANAMA. BOCAS DEL TORO: Río Culebre, *Gomez et al. 22387* (CR, G, MO); Chiriquicito–Calderas Trail, *Kirkbride & Duke 993* (MO). CHIRIQUI: between Fortuna Lake and Chiriquí Grande, *Croat & Grayum 59994* (MO, PMA); Bajo Chorro, Boquete, *Davidson 243* (F, MO, US); Palo Alto NE of Boquete, *Hammel 6066* (MO); Cerro Hornito, *Hammel 6219* (MO, NY, PMA); Cerro Punta, *Hammel et al. 6532* (MO); Palo Alto, *Hammel 7449* (MO); Cerro Horqueta, *Luteyn & Wilbur 4609* (DUKE); Cerro Pate Macho, *McPherson 8058* (MEXU, MO, PMA); Cerro Hornito, *Mori 7504* (BM, MEXU, MO, PMA); Cerro Punta, *van der Werff & Herrera 6311* (G, MO); Cerro Horqueta, *Wilbur & Luteyn 19332* (DUKE). VERAGUAS: Cerro Tute, *Mori et al. 7599* (BM, MO).

9. Ilex yurumanguinis Cuatrecasas, Lloydia 11(3): 210. 1948. TYPE: Colombia. Valle: Río Yurumanguí, Veneral, bosques en la Quebrada del Zancudo, 10–50 m, 10 Feb. 1944, *Cuatrecasas 16156* (holotype, US 1951538; isotype, F).

This species occurs in wet forests from sea level to 1,500 m in Panama through northwest Colombia into Ecuador, with an outlying population on the Cocos Islands. In western Panama, the species flowers at the end of the dry season from (December) February to April and fruits in July and August. Populations in central and eastern Panama flower slightly earlier (November to February).

Collections from eastern Panama (Colón, Darién, Panamá, and San Blas) from below 500 m elevation are virtually identical to material from the type locality of the Río Yurumanguí in Valle, Colombia, with thick leaves, distinct rounded crenulations, a rounded, obtuse apex, and revolute margins.

Populations from elevations of 700–1,000 m in Coclé and 1,000–1,500 m in Chiriquí and Bocas del Toro are characterized by thinner leaves that dry strongly bicolored, the leaf apex long acuminate, the marginal crenulations less rounded or laterally flattened and almost entire with only a few scattered spines, thinner pedicels and peduncles, and more

delicate cymes. These specimens approach *I. maxima* in leaf shape but have much smaller leaves with fewer secondary veins, smaller fruits, and different flowering and fruiting times. These populations perhaps deserve specific status, but further study of the Colombian taxa is still needed.

One unusual collection from the ridge of Cerro Caracoral (*Sytsma 3824*) shows strongly reduced, spatulate leaves and denser ramification, possibly due to the windswept habitat.

Two collections from Bocas del Toro near the Fortuna Dam site (*McPherson 9050B* and *Croat 59994*) show such features as broader and thicker leaves and more grayish bark, which approach *I. chiriquensis*. These two gatherings were made in the vicinity of *McPherson 9050A* and *Croat 59995*, which fall well within the morphological range of the upland *I. yurumanguinis* form. These may be hybrids, as both species are found in the area.

Cuatrecasas placed *I. yurumanguinis* near *I. laureola* Triana and *I. affinis* Gardner, two species relegated by Loesener (1901, 1908) to series *Thyrsiprinus* sect. *Thyrsiflorae*.

Additional specimens examined. PANAMA. CHIRIQUI: road from Fortuna Lake to Chiriquí Grande, *Hampshire & Whitefoord 425* (BM); 1 km N of Fortuna Lake, *Hampshire & Whitefoord 940* (BM); Fortuna Dam, *McPherson 8731* (MEXU, MO, PMA), *McPherson 9125* (MEXU, MO, PMA); Boquete, Fortuna Dam site, *van der Werff & van Hardeveld 6815* (G, MO, PMA). COCLE: Cerro Caracoral, *Duke & Dwyer 15078* (MO, NY); above El Valle, *McPherson 12151* (BM); La Mesa, *Nee & Dwyer 9157* (DUKE, F, MO, OSU, PMA, US); Cerro Caracoral, *Sytsma 3824* (MO). COLON: East Ridge, *Duke 15270* (MO). BOCAS DEL TORO: Finca Serrano, NE of Boquete, *Hammel 6168* (DUKE, MO, NY, PMA, US); Fortuna Dam Forest, *McPherson 9050* (MEXU, MO, PMA). DARIEN: S of Garachineon W slope of Serrania Sapo, *McPherson et al. 15379* (MO). PANAMA: Rancho Chorro, Torti Arriba, *Folsom et al. 6712* (MO, NY); El Llano–Carti Road, km 16–18.5, *Nee & Tyson 10957* (MO). SAN BLAS: trail along Continental Divide, *McDonagh et al. 302* (BM, MO).

10. Ilex maxima W. J. Hahn, sp. nov. TYPE: Panama. Coclé: La Mesa, 4 km N of El Valle, 875 m, *Nee & Hale 9626* (holotype, MO 38211595; isotypes, BM, F, G, MEXU, PMA, US). Figure 4.

Arbor; caules arcuati; folia tenui-coriacea, punctata, 15–40 cm longa, 10–15 cm lata; inflorescentiae dichasiis fasciculatis; inflorescentia staminata ramosa; inflorescentia pistillata non ramosa.

Tree to 10 m tall, laxly ramified, the branches often arching. Stems slightly angular-ridged when dry, glabrous; lenticels scattered on young stems, abundant on older stems, oval, split, 0.6–1.3 mm long, 0.3–0.7 mm wide; bark thin, tannish gray; stipules to 2 mm long, appearing as extensions of bark. Leaves thick chartaceous to coriaceous, drying dark brown-green adaxially, pale tan abaxially, mostly glabrous, punctate abaxially, elliptic, 15–40 cm long, 10–15 cm wide, the apex acute, the base attenuate, the margin laterally flat, subentire with occasional spines, very slightly crenulate toward the apex; venation strongly brochidodromous, the secondary veins 10–20 per side, the tertiary veins reticulate, distinct; petioles thickened, 1.5–2 cm long, drying black or dark brown. Staminate inflorescence of compound cymes borne on a much reduced stem resembling an axillary panicle; cymes branched to 2 orders, 1–3 flowers per inflorescence, bracts coriaceous, scale-like, ovate-rounded, 1–2 mm long, 1–1.5 mm wide; peduncle 0.5–1 cm long, 0.4–0.6 mm wide, laterally flattened; peduncular bracts triangular, ca. 1 mm long, 0.5 mm wide, induplicately folded, oppositely paired or distinctly offset; pedicels 0.3–1 cm long, 0.3–0.4 mm wide, laterally flattened; floral bracteoles paired at the base of the pedicels, small. Pistillate inflorescences of unbranched cymes clustered on a much reduced stem with the complete ensemble resembling a cyme, the stem not expanding in fruit; 1 flower per dichasium; bracts coriaceous, deltoid, 1–2 mm long, 1.5–2.5 mm wide; peduncle 0.8–1 cm long, 0.3–0.6 mm wide, flattened in cross section, tapering; peduncular bracts, paired or essentially so, membranaceous, deltoid, 0.8–1.2 mm long, 0.3–0.7 mm wide; pedicels 1–2 mm long, 0.1–0.2 mm wide, round in cross section; floral bracteoles minute. Staminate flowers 4-merous; calyx broad cupuliform, sometimes urceolate, the sepals glabrous, ovate-deltoid, 1.2–1.5 mm long, 1.2–1.5 mm wide, the margin mostly regular, induplicately folded; corolla rotate, the petals white, glabrous, 2–2.5 mm long, 1.5–2 mm wide, the margin entire; filaments 2–2.5 mm long, flattened, tapering, the anthers yellow, ovoid, tapering, 1–1.5 mm long, 0.3–0.6 mm wide; pistillodia spherical-conical, 0.4–0.6 mm tall, 0.8–1.2 mm diam., the stigma cylindrical, 0.1–0.3 mm tall. Pistillate flowers unknown. Fruit spherical to ellipsoid, 0.8–1 cm long, 0.5–0.7 mm diam.; pericarp leathery, moderately thick, dark purple at maturity, stigma persistent, spreading to slightly flattened capitate, 2–2.5 mm diam., 1 mm high, 4-lobed; mesocarp moderately thick, fleshy; pyrenes 4, trigonal 4 mm long, 1–1.5 mm wide, shallowly channeled, endocarp bony.

Ilex maxima occurs in wet forest in the Cordillera Central of Costa Rica, the Talamancas of Costa Rica and Panama through central Panama to the western slopes of the Andes in Colombia. It generally occurs

Figure 4. *Ilex maxima* W. J. Hahn. —A. Habit (*Nee & Hale 9626*). —B. Fruits (*Stevens 18321*).

at elevations of 700–1,000 m, except to 1,500 m in the Talamancas and lower elevations in Colombia. Flowering is at the end of the wet season into the onset of the dry season, from September to November, and fruiting is from January to April.

Ilex maxima is characterized by its lax habit, cymes borne clustered on reduced stems in flower and fruit often appearing cauliferous, the large spherical fruits, and the very large, elliptic leaves. It is closely related to *I. tatei* of the Guayana Highland region of Venezuela and *I. yurumanguinis* Cuatrecasas of northwestern Colombia and Panama, but differs in its larger and relatively thicker leaves with more secondary veins, the larger, more robust staminate inflorescences, and the larger fruits. Other apparently related taxa include a number of Colombian species such as *I. caliana* Cuatrecasas and *I. laurina* Kunth, which have been referred to section *Daphnophyllae* (Loesener, 1901, 1908).

Paratype. PANAMA. CHIRIQUI: confluence of the Río Hornito and Río Chiriquí, *Stevens 18321* (MO, UTD).

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A New Species and a New Combination in *Salpichroa* (Solanaceae)

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ABSTRACT. A monographic study of the genus *Salpichroa* revealed a new species, *S. microloba*, and one taxon with a new status, *S. glandulosa* subsp. *weddellii*. These taxa are discussed and information on their probable relationships is given.

Salpichroa glandulosa (Hooker) Miers subsp. **weddellii** (Benoist) Keel, stat. et comb. nov. Basionym: *Salpichroa weddellii* Benoist, Bull. Soc. Bot. France 85: 408. 1938. TYPE: Bolivia. Cochabamba: between Llave and Morochata, Dec. 1846 (fl), *Weddell 4116* (holotype, P; isotypes, P—2 sheets).

A study of the genus *Salpichroa* (Keel, 1984) gave clear indication that *S. glandulosa* consists of two subspecies, *Salpichroa glandulosa* subsp. *weddellii* and *S. glandulosa* subsp. *glandulosa*, that are similar in growth habit, habitat preference, and many aspects of morphology. The morphological characters that distinguish subspecies *weddellii* from subspecies *glandulosa* include (1) absence of teeth between the sinuses of the corolla lobes and (2) long pedicels with calyx bases that do not enlarge after fruiting. The two taxa, representing populations separated geographically by the Cordillera Tres Cruces in Bolivia, are best treated as vicariant subspecies.

Salpichroa microloba Keel, sp. nov. TYPE: Peru. Lima: Arquircancha, near Lachaqui, 3,658 m, 2 Feb. 1979 (fl, fr), *Keel & Vilcapoma 397* (holotype, NY; isotypes, MO, USM). Figure 1.

Frutices penduli vel effusi ad 1 m alti. Rami et ramuli interdum flexuosi. Folia ovata vel elliptica; petioli subfiliformes vel complanati. Flores flavi vel viridi-flavescentes. Pedicelli filiformes. Calyx profunde 5-partitus, lobis linearibus, apice acutis vel attenuatis, connatis solum basi. Corolla 5-lobata, tubulosa, tubo recto vel apicem versus leviter dilatato, sed constricto ad faucem, lobis aestivatione valvatis, triangulatis vel ovato-triangulatis, apice acutis, ciliatis, sub anthesi per 180° reflexis. Stamina prope tubi apicem inserta. Stylus glaber, leviter exsertus vel tubum aequans, stamina excedens, stigmate subcapitato vel capitato. Bacca cyanea vel purpurea.

Pendent or straggling *shrubs* to 1 m tall, the young stems, leaves, and pedicels puberulous, pilose or glabrous, sometimes with gland-tipped trichomes. *Branches* and *twigs* terete, flexuous, sometimes winged on 1 to 3 sides, each node occasionally with 2 to 4 semicircular or circular scales. *Leaf blades* ovate or elliptic, (1–)1.5–2.8(–3.6) × (0.6–)1–2.1(–3) cm; *petioles* subfiliform to flattened, 0.6–1.8 cm long. *Pedicels* filiform, 0.5–1.5 cm long; *calyx* deeply divided, the lobes linear, subequal, 5–13 × 0.5–2.5 mm, ciliate, pilose, puberulous or glabrous, connate at the base, apex acute or attenuate; *corolla* tubular, yellow or yellowish green, the tube straight, slightly inflated on upper part, constricted at the throat, 22–34 × 3–7 mm, glabrous or puberulous externally, glabrous internally, the lobes triangular or ovate-triangular, equal to subequal, valvate, 2–3 × 1.5–3 mm, ciliate, apex acute, reflexed by 180° at anthesis; *stamens* included, equal or subequal, inserted at top ⅕ of the tube, the filaments 0.5–1.5 mm, glabrous, the anthers 2.5–4 mm; *style* nearly equal to the throat of corolla tube or slightly exserted, exceeding stamens, 2–3 cm long, glabrous, the stigma capitate or subcapitate, glabrous. *Berry* dark blue or purple, 3 cm long.

Distribution. Sub-puna or montane cloud forests, near creeks, in agricultural fields, hedgerows, on roadsides, grass steppes, or on stone walls, rock crevices; 2,400–3,800 m; in the Department of Cotopaxi, central Ecuador (one collection only) and west-central Peru. Flowering December–May, fruits found in February.

Salpichroa microloba shows slight variation in degree of pubescence and size of leaves. *Cerrate & Tovar 1909* is exceptional for its large, glabrous leaves and wide corolla tubes. *Salpichroa microloba* and *S. weberbaueri* Dammer have nearly the same corolla length, but the shapes of corolla tubes and lobes, which are best seen in living plants, are very different. At anthesis, the corolla tube of *S. microloba* is constricted at its throat and the triangular or ovate-triangular corolla lobes are reflexed by 180°. The corolla tube of *S. weberbaueri* widens at the upper third of the tube; the lobes, from horizontally spreading to reflexed by 135° at anthesis, are triangular-lanceolate. In the field, one can easily sep-

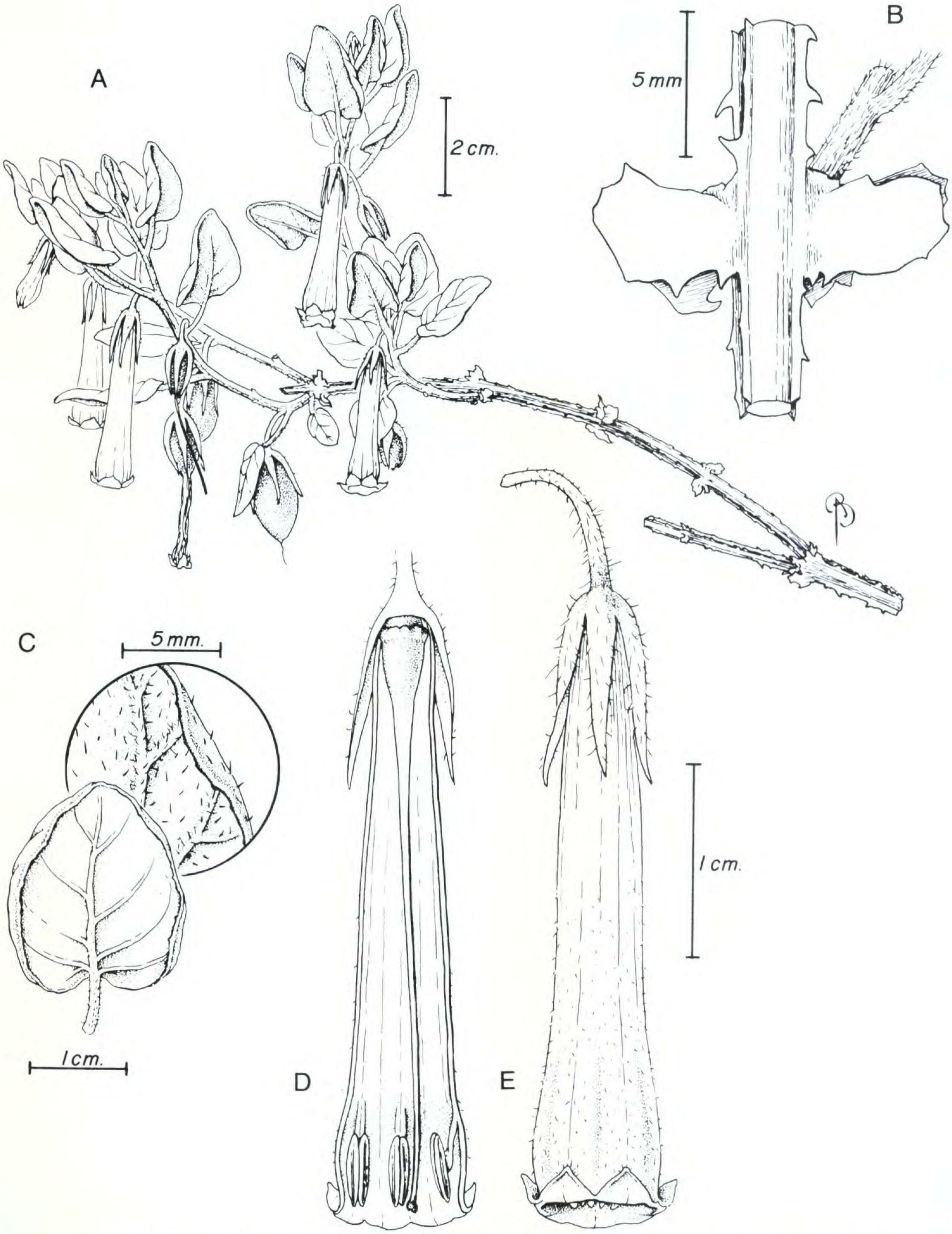

Figure 1. *Salpichroa microloba* Keel. —A. Branch. —B. Winged stem and scales. —C. Leaf and pubescence. —D. Internal view of flower. —E. External view of flower; note the small corolla lobes.

arate them by the shape of corolla and the degree of reflection of the corolla lobes at anthesis. The specific epithet, *microloba*, refers to the relatively small size of the corolla lobes compared to the tube.

Salpichroa microloba is probably most closely related to *S. ramosissima* Miers. Although the length of corolla tube of these two species is quite different (2.2–3.4 cm long in *S. microloba*, and 0.9–1.5 cm

in *S. ramosissima*), the shape of corolla and the reflection angle of lobes at anthesis are similar.

Salpichroa microloba has been collected in central Ecuador, Department of Cotopaxi, and west-central Peru. *Salpichroa ramosissima* grows in the western part of central and southern Peru, and in southern Bolivia and northwestern Argentina. The ranges of the two species overlap in the Department of Lima, Peru.

Local names. Peru: Ayanata (*Keel & Vilcapoma 397*, *Vilcapoma 129*), Callalluma (*Vilcapoma 130*), Shuculumpa (*Cerrate & Tovar 1909*).

Paratypes. ECUADOR. COTOPAXI: road Quevedo–Latacunga, above Pilaló, ca. 2,900 m, 3 May 1968 (fl), *Harling et al. 8993* (GB, MO). PERU. LIMA: Baños, on the way to Cerro de Pasco, *Wilkes*, 21–22 May 1839 (collecting date based on Wilkes, 1845) (fl) (US); Lachaqui, 3,800 m, 28 Dec. 1972 (fl), *Vilcapoma 129* (US), 3,400 m, 29 Dec. 1972 (fl), *Vilcapoma 130* (US); Pirocancha, on the way to Lachaqui, 3,440 m, 1 Feb. 1979 (fl, fr), *Keel & Vilcapoma 390* (MO, NY, US, USM); Achaca, few km beyond Lachaqui, 3,658 m, 2 Feb. 1979 (fl, fr), *Keel & Vilcapoma 396* (NY, USM); Matucana, 2,438 m, 14–18 Mar. 1923 (fl), *Macbride 2946* (F); vic. of Huarochirí, western cordillera, 2,100–3,000 m, *Hrdlicka*, Feb. 1913 (fl) (US); vic. of Santiago, 3,600–3,700 m, 15 May 1953 (fl), *Cerrate & Tovar 1909* (US).

Acknowledgments. This paper is part of results of my doctoral dissertation. I am grateful to Ghillean T. Prance for useful advice, Rupert C. Barneby for help with the Latin description, Bobbi Angell for her plant illustrations, and William G. D'Arcy for reviewing the manuscript. The curators of herbaria who made specimens available for study are thankfully acknowledged.

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Calathea liesneri, a New Species of Marantaceae from Venezuela

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ABSTRACT. *Calathea liesneri*, from Territorio Federal Amazonas, Venezuela, is unusual in having the upper side of the lamina pilose throughout. It differs from other species sharing this feature by leaf shape, and bract shape and number. It is herein described as new for inclusion in the *Flora of the Venezuelan Guyana* treatment.

Calathea liesneri Kennedy, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Atabapo, in saddle between Cerro Duida and Cerro Marahuaca near base of Cerro Duida, medium height forest, 1,000 m, 03°34′N, 65°32′W, 25 Oct. 1988, *Liesner 25333* (holotype, MO; isotypes, K, UBC, VEN).

A *Calathea cyclophora* lamina superior utrinque pilosa et bracteolis membranaceis differt; a *Calathea squarrosa* bracteis 7–10, transverse ellipticis ad rotundatis et 2–2.9 cm longis differt.

Acaulescent herb, 35–80 cm high, bearing 2–4 basal leaves. Leaf blade elliptic, apex acuminate, base obtuse to rounded, very shortly abruptly attenuate, 12–40 × 9–14 cm. Leaf blade green above, pilose throughout; leaf surface gray-green, velvety tomentose below. Pulvinus elliptic in cross section, tomentose throughout, 0.5–2.3 cm long. Petiole 0–29 cm long, tomentose, hairs with cushion of cells at base. Leaf sheath not auriculate, tomentose to subhispid toward base, margins subglabrous, 14.5–30 cm long. Inflorescence terminal, 1 per shoot, imbricate, ellipsoid, 5–6.5 cm. Peduncle pilose, hairs with cushion of cells at base, 40–64 cm long. Bracts 7–10, spirally arranged, transverse elliptic to rotund, apex rounded with an acumen to obtuse, outer margin and apex patent, margin slightly undulate in upper bracts, 2–2.9 × 2–2.8 cm, each subtending 4 or more flower pairs. Outer surface of bracts "lavenderish white" (fide *Liesner 25654*), glabrous; inner surface glabrous. Bicarinate prophyll membranaceous, elliptic, apex obtuse, glabrous, 1.7–2.5 × 1.2–1.4 cm, 0.6–0.7 cm wide, carina to carina. Secondary bract membranaceous, elliptic, apex acute to obtuse, glabrous, 1.7–2.2 × 1–1.2 cm. Bracteoles 1 per flower pair, channeled, membranaceous, medial, glabrous, ca. 1.2 cm long. Flowers "lavenderish white" (fide *Liesner 25654*). Sepals ovate to elliptic, acute, glabrous, 6.5–9.5 × 2.5–3 mm. Corolla glabrous, ca. 50 mm, tube ca. 30 mm long; corolla lobes subequal, elliptic, obtuse, ca. 15–19 × 5.5–8.5 mm. Outer staminode obovate, ca. 15 mm long. Callose staminode petaloid, ca. 13 × 4 mm. Cucullate staminode ca. 8 mm long. Stamen with lateral petaloid appendage; anther 2.5 mm long. Ovary glabrous, ca. 2 mm long. Capsule smooth, obovoid, glabrous, ca. 10 × 7 mm; crowned by a persistent calyx. Seeds usually 3 per capsule, trigonal, ca. 6–7 × 4 × 3 mm.

Calathea liesneri belongs to *Calathea* sect. *Breviscapus* Bentham, by virtue of its all basal leaves and inflorescence with spiral bracts borne on the leafy shoot.

Paratype. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Depto. Atabapo, Cerro Huachamacari, E slope, forested, near waterfall, 03°49′N, 65°42′W, 600–700 m, 2 Nov. 1988, *Liesner 25654* (MO, UBC, VEN).

Acknowledgments. I thank the curators at Missouri Botanical Garden for the loan of material and Paul Berry for help with the *Flora of the Venezuelan Guyana* project. I thank Fred Ganders for support and Tom Baumann for the use of his computer.

New Taxa in *Maerua* (Capparaceae) proposed for the *Flora of Ethiopia*

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ABSTRACT. During studies of Capparaceae carried out for the *Flora of Ethiopia*, the following new taxa in *Maerua* were discovered.

Maerua intricata Kers, sp. nov. TYPE: Ethiopia. Ogaden: Mustahil to Ferfer, 5 Dec. 1954, *Peggy E. Ellis 357* (holotype, K).

A speciebus quas A. Brongniart et alii auctores ad *Courboniam* ascripserunt habitu intricato foliis minutis costa plerumque immersa ideo utrinque occulta distinguenda, ab eis etiam in combinatione petioli brevissimi (ut in *M. pseudopetalosa* (Gilg & C. Benedict) De Wolf) cum fructibus ellipsoidalibus basi regulariter per quattuor valvas dehiscentibus (ut in *M. subcordata* (Gilg) de Wolf) differt.

Virgate shrub 0.5–2 m tall, intricately branched, stems erect or ascending, glabrous, ± minutely scabrous, branches and branchlets stiffly divaricate, somewhat striate. Leaves simple, minute, 5–15 mm long, 1–5(–8) mm wide, stiff, coriaceous, narrowly elliptic, oblong or lanceolate, seemingly often nerveless (midrib imbedded), petiole very short, 0.5–1.5(–2) mm long. Flowers without petals, solitary and axillary; pedicel short, 7–11(–13) mm long; receptacle cylindric, (2–)3–4.5 mm long; sepals three, (6–)8–10 mm long; androgynophore finally exceeding the receptacle by 1–2.5 mm; stamens ca. 20–25; gynophore 12–16 mm long, longer than the pedicel; ovary fusiform, 4-nerved; placenta 2, ovules two on each placenta. Fruit broadly ellipsoid, with one or rarely two seeds, pericarp finally breaking up into four valves at the very base of the fruit, otherwise indehiscent. Seed (9–)14–15 mm long, narrowly ovate to oblong, cotyledons pale yellowish.

Maerua intricata is clearly allied to the species of *Maerua* that were formerly grouped in the genus *Courbonia* Brongniart. It differs in the intricately branched growth, the minute leaves with a generally completely immersed and consequently hidden midrib. The petioles are as short as in *M. pseudopetalosa*, whereas in shape and mode of dehiscence the fruits are comparable with those of *M. subcordata*.

Distribution. Known from the area around the River Schebelli in eastern Ethiopia and central Somalia and from there north into the African Horn of the northeastern Somali Republic; from 100 m near the coast to 350 m inland.

Habitat. In *Acacia–Commiphora* bushland or in scattered low bush. Growing on rocky slopes, in stony soil at foot of hills, in sandy areas with limestone ridges or in dry water courses.

Indigenous names. Cagàt, cagah (Bari region), Dugal erigiren (Hiraan region).

Paratypes. ETHIOPIA. OGADEN: Scivelli to Beletuen, June 1943, *Hummel 151* (K); Webi (= Schebelli River), July–Aug. 1891, *Robecchi-Brichetti 228* (FT). SOMALIA REPUBLIC. SANAAG REGION: below Einad, 11°55′N, 48°55′E, 1957, *Newbould 1022* (K). BARI REGION: Alula, without date, *Anonymous s.n.* (FT fragments); along road from Alula to Seyn Wayn, 9 Oct. 1982, *Barbier 939* (FT, K); near Bender Merhagno, 11°41′N, 50°27′E, 15 Oct. 1982, *Barbier 946* (K); Mt. Bolimock W of Alula, 29 Oct. 1959, *Hemming 1786* (K); 40 km SW of Alula, 11°55′N, 50°30′E, 14 Nov. 1980, *Hemming & Watson 3087* (K); near Bosaso, to Cassim Bender, 7 July 1924, *Puccioni & Stefanini 1034* (= *1136*) (FT); Wadi Merero, *Scortecci*, 1957 (FT); mountain pass W of Bargal, ca. 11°15′N, 51°00′E, 25 Nov. 1985, *Thulin & Warfa 5532* (UPS); mountains S of Bender Murrayha, valley above Tayeega, 29 Oct. 1959, *Thulin & Warfa 5814* (K, UPS). NUGAAL REGION: valley slope of Nugal River, 7 Oct. 1959, *Hemming 1679* (K). MUDUG REGION: 69 km SW of Galkayo on main road, 06°27′N, 46°53′E, 4 June 1979, *Gillett, Hemming & Watson 22347* (K). HIRAAN REGION: 03°06′N, 45°04′E, 1 Aug. 1983, *Abukar Sheik 2023* (K); Bulo Burti district, 4 km N of Murkayale, 03°50′N, 45°13′E, 28 Sep. 1986, *Kuchar 17082* (K); El Mocoile, on road from Bulo Burti to Galgiel, 5 Apr. 1933, *Suckert 66* (FT, K).

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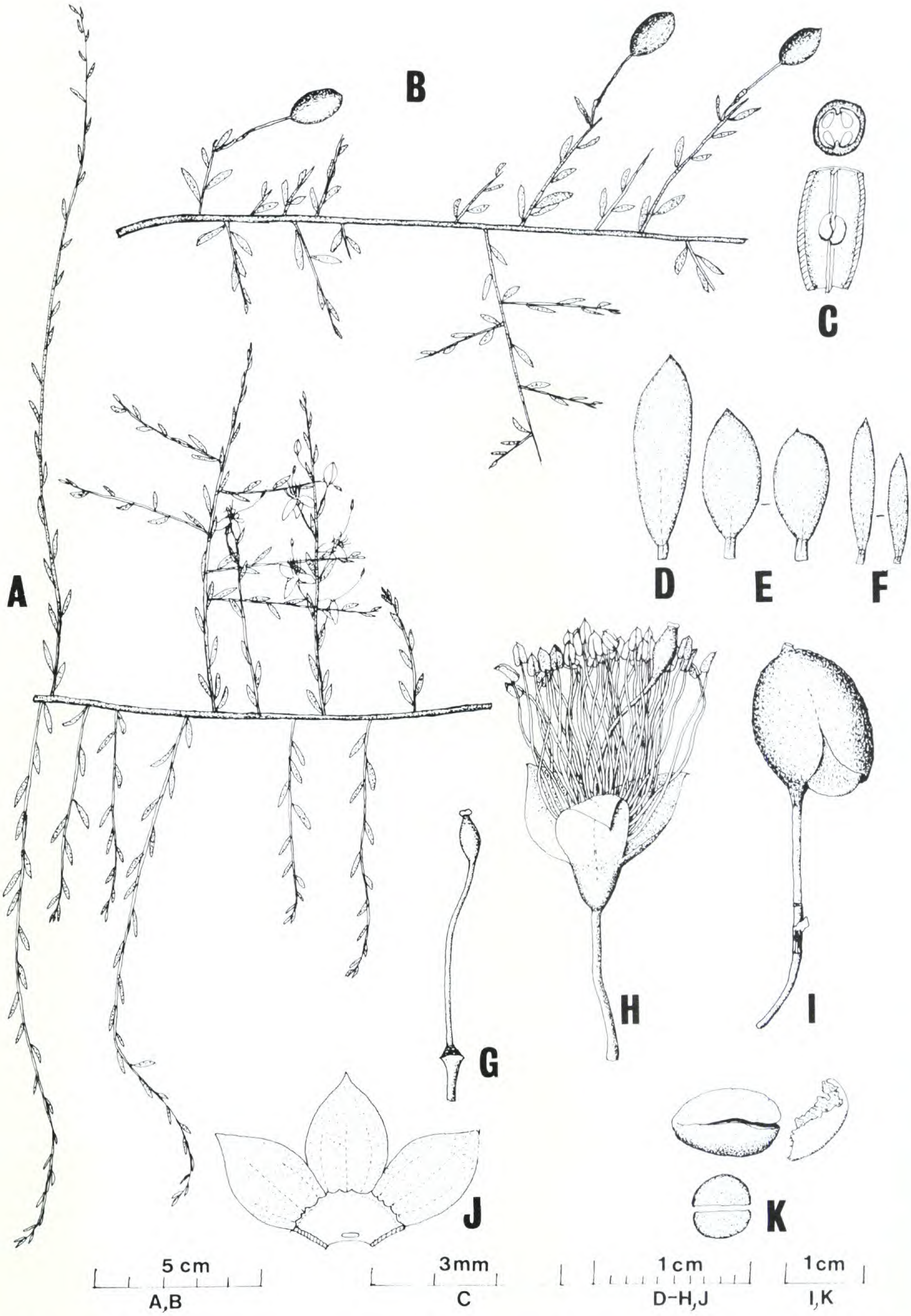
Figure 1. *Maerua intricata* Kers. —A. Portion of stem with flowering twigs. —B. Portion of stem with immature fruits. —C. Ovary in transversal and longitudinal sections. —D–F. Leaves. —G. Gynophore with ovary, torus with stamen scars, androgynophore. —H. Flower. —I. Mature fruit showing the basal dehiscence, seed partially exposed.



—J. Receptacle opened showing sepals and the minute corona. —K. Embryo in lateral view and transversal section showing the cotyledons. Fragment of the seed coat (right). A, F, *Abukar Sheik 2023* (K); B, *Suckert 66* (FT); C, E, G, H, J, *Barbier 939* (FT); D, *Barbier 946* (K); I, K, *Thulin & Warfa 5814* (UPS).

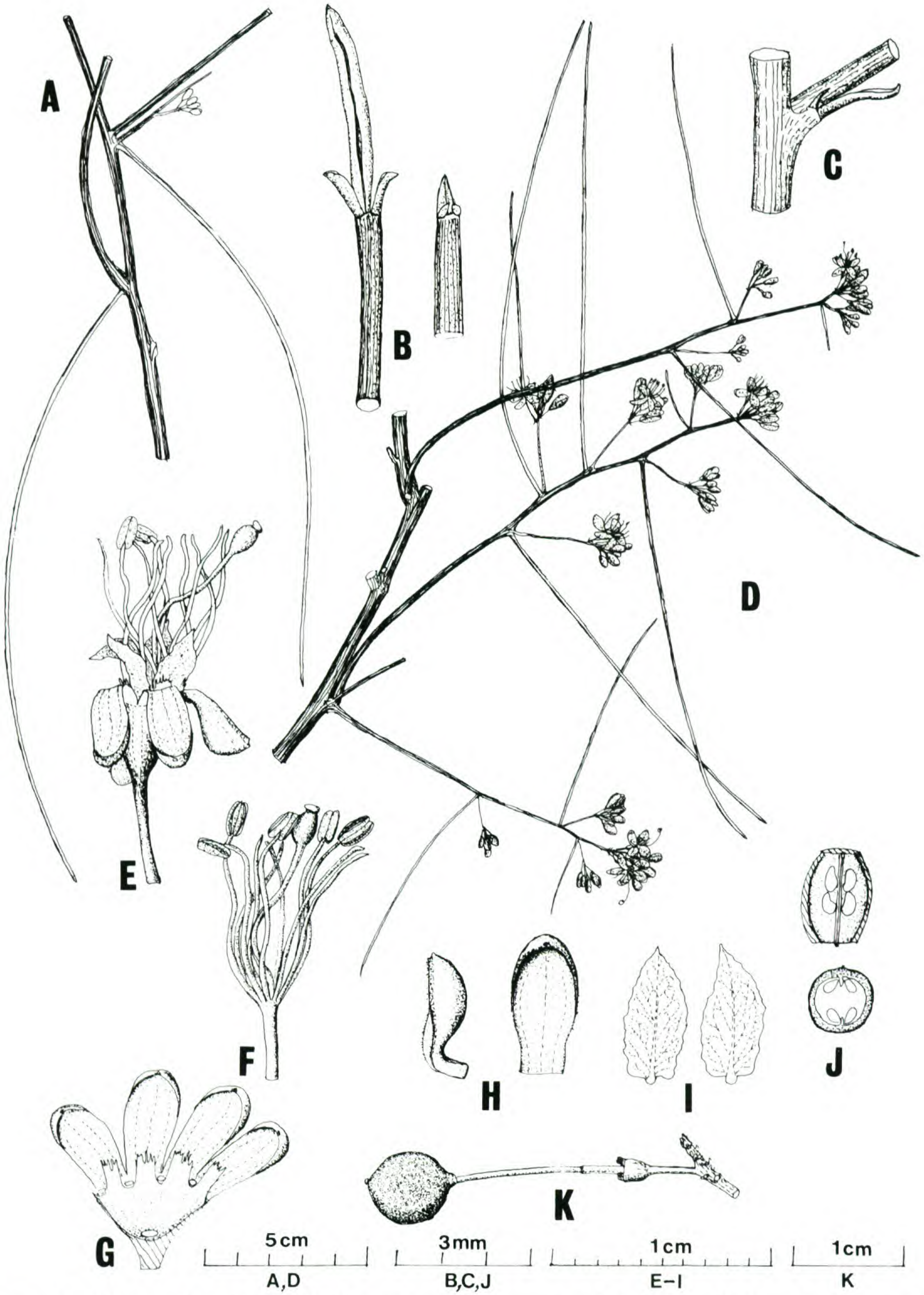


Figure 2. *Maerua gillettii* Kers. —A. Portion of stem showing reflexed phyllodes. —B. Apex of petioles with rudimentary leaflets. —C. Floral bract with stipule. —D. Portion of stem with flowering twigs and spreading phyllodes. —E. Flower. —F. Androgynophore, stamens, gynophore with ovary. —G. Receptacle opened showing sepals and the lobed corona. —H. Sepals. —I. Petals. —J. Ovary in longitudinal and transversal section. —K. Fruit with gynophore, androgynophore, receptacle, and pedicel. A–J, *Bally & Smith 14887* (K); K, *Haugen 1915* (S).

Maerua gillettii Kers, sp. nov. TYPE: Kenya. Northern Frontier Province: Moyale, 15 km out Waijir road, 03°25′N, 39°07′E, 5 Nov. 1952, *J. B. Gillett 14148* (holotype, K; isotype, FT). "*Maerua spec. A*" in *Flora of Tropical East Africa, Capparaceae*, 49–50, 1964.

Haec species *M. glaucae* Chiovenda verosimiliter affinis sed phyllodia habet ideo inter omnes Maeruas africanas bene distincta.

Shrub, glabrous, to 1.5 m tall, stems green, striate and slender but generally rigid, branches and branchlets divaricate. Leaves well spaced, initially 3-foliolate but readily forming phyllodes; leaflets very reduced, rudimentary, scarious and usually dropping off early; petioles transformed into phyllodes. Phyllodes similar to the stems, becoming reflexed, gradually elongating, finally up to 19 cm long. Inflorescences few-flowered and rather loose, racemose or corymbose; pedicel short, 4–6(–9) mm long; flowers small; sepals 4, 4–5 mm long; petals elliptic, 3–4(–5) mm long; receptacle shortly cylindric to narrowly campanulate, 2.5–3 mm long; corona 1–1.75 mm long, cleft to base into usually four segments; stamens 8–10(–12), 0.8–1.1 cm long, borne in one series; anthers 1 mm long. Androgynophore 4.5–5.5(–6) mm long, exceeding the receptacle by (2–)4–5 mm. Gynophore thin, ca. 1.2 cm long. Ovary 1–1.5 mm long, ellipsoid at first; placenta 2; ovules 8; stigma sessile to subsessile. Fruit globose to subglobose, ca. 0.5 cm diam., smooth, generally 1-seeded. Seed subspherical, filling the interior of the fruit, mature seeds unknown.

Maerua gillettii is well characterized by its stem-like phyllodes, which are not found in other African Maeruas. The phyllodes are usually reflexed, with early dropped rudimentary leaflets. The flowers and fruits are similar to those of *M. glauca* Chiovenda, a species that differs in having ordinary leaves and a longer pedicel (to 1.8 cm long).

Maerua filiformis Drake from Madagascar develops phyllodes, but they are not reflexed; this species differs also in its narrowly cylindrical receptacle 3–4 mm long, the shorter androgynophore exceeding the receptacle by only 1 mm, the inconspicuous or practically wanting corona, the subcordate, 2.5–3-mm-long petals, and the ovate to subglobose shape and blunt apex of the ovary.

Distribution. Only known from northernmost Kenya and the adjacent parts of southern Ethiopia; from 600 m in Kenya, to 1,400 m in Ethiopia. Reported to be locally common below 1,300 m in southern Ethiopia.

Habitat. In *Acacia–Commiphora* scrub or in *Acacia mellifera* bushland. Growing on sandy or loamy soil near exposed bedrock of granite, gneiss, or schist. Average rainfall in northern Kenya 635 mm/year with maximum rainfall in April and October.

This species is named after Jan B. Gillett (K), formerly of the East African Herbarium in Nairobi, an acknowledged expert on the flora of northeastern Africa and an important collector.

Paratypes. KENYA. NORTHERN FRONTIER PROVINCE: S end of Huri Hills, 25 Feb. 1963, *Bally 12531* (K); 16 km SE of Sololo on road to Moyale, ca. 03°26′N, 38°42′E, 18 Jan. 1972, *Bally & Smith B 14887* (K); Huri Hills, ca. 03°25′N, 37°46′E, 4 Nov. 1976, *Herlodier 179* (K). ETHIOPIA. SIDAMO PROVINCE: Hadessa, ca. 70 km S of Neghelle, 11 Nov. 1991, *Haugen 1943* (S); ca. 60 km from Neghelle, on road to Dawa River, ca. 90 km from Dawa, 9 Feb. 1991, *Haugen 1915* (S).

THE *MAERUA ANGOLENSIS* COMPLEX OF NORTHEAST AFRICA

Two species are involved in the *Maerua angolensis* complex of northeast Africa: *M. angolensis* DC. (sens. str.), which is widely distributed in Africa and also extends into Arabia; and *M. socotrana* (Schweinfurth ex I. B. Balfour) Gilg, based on specimens from Socotra. The Socotran population and *M. angolensis* are easily separated by the length of the receptacle and the size of flowers and leaf blades. They also differ in habit, *M. socotrana* being a much more slender-stemmed shrub or low tree. These clearly distinct taxa were found to almost grade into each other by means of numerous, more or less isolated populations growing in the Somali Republic and eastern Ethiopia. When previously determined, these atypical specimens had generally been labeled *M. socotrana*. Sometimes the name *M. thomsonii* T. Anderson had been applied to them.

Maerua angolensis and *M. socotrana* cannot be kept separate specifically. The broad concept of *M. angolensis* results in a complex species. The morphological variation within this complex is not continuous and is subdivided into the taxonomic entities presented below. These differ in a number of features, of which only the more easily observed and measured are mentioned here. A more detailed treatment of them will be found in the *Flora of Ethiopia*. The geographical areas of the allied taxa seldom meet or overlap. Further studies of the complex will be of great biogeographical interest.

The Socotran population (*M. socotrana* sens. str.) is fairly uniform and can be separated taxonomically on a subspecific level. To some extent, its distinctness may be due to geographical isolation within a small area.

Maerua thomsonii T. Anderson was described in

1860 from Aden. This species has previously been regarded as identical to *M. socotrana* (Elffers et al., 1964). *Maerua thomsonii* is not, however, a close ally and does not belong to this complex.

KEY TO THE INFRASPECIFIC ENTITIES OF *MAERUA ANGOLENSIS*

1a. Receptacle (7–)9–15(–19) mm long, cylindrical, androgynophore (9–)11–18(–20) mm long, exceeding the receptacle by 2–5 mm; leaf blades commonly 2–5.5 cm long; low trees with a rounded crown or shrubs, much branched . . . . . subsp. *angolensis*

1b. Receptacle 2–6(–9) mm long, cylindrical, infundibular or campanulate, androgynophore (3.5–)4–7(–11) mm long, equal or exceeding the receptacle by 1–5 mm; leaf blades 1–2(–3) cm long; low, often very slender trees or shrubs, few-branched . . . . . subsp. *socotrana*

2a. Sepals 0.5–1 cm long, stamens (0.5–)0.7–1(–1.5) cm long, receptacle 2–3(–4) mm long . . . . . subsp. *socotrana* var. *socotrana*

2b. Sepals 1.2–2.2 cm long, stamens 1.5–2.4 cm long, receptacle 2–6 mm long . . . . . subsp. *socotrana* var. *africana*

1. Maerua angolensis DC. subsp. **angolensis.** TYPE: Angola. Benguela: *José da Silva s.n.* (holotype, P).

This subspecies is characterized by the long receptacle, commonly 9–15 mm long, and by the long androgynophore, commonly 11–18 mm long. It varies in shape of leaf blades, direction of sepals (spreading or reflexed), and hairiness. Widely distributed in Africa; also found in Arabia.

2. Maerua angolensis DC. subsp. **socotrana** (Schweinfurth ex I. B. Balfour) Kers, stat. nov. Basionym: *Maerua angolensis* DC. var. *socotrana* Schweinfurth ex I. B. Balfour, Proc. Roy. Bot. Gard. Edinburgh 12: 402, 1883. *Maerua socotrana* (Schweinfurth ex I. B. Balfour) Gilg, Engler Bot. Jahrb. 33: 228, 1903. SYNTYPES: Socotra, *Bayley Balfour 193* (BM), *588* (B, BM, P); *Schweinfurth 251* (not seen), *457* (B, P), *603* (P).

The flowers are smaller than in subspecies *angolensis*, with a receptacle commonly 2–6 mm long and with an androgynophore commonly 4–7 mm long and sometimes not exceeding the receptacle.

Distribution. Ethiopia, Somalia, and Socotra.

2A. Maerua angolensis DC. (subsp. *socotrana*) var. **socotrana.** TYPE: as for *M. angolensis* DC. subsp. *socotrana.*

Sepals 0.5–1 cm long, 2.75–4 mm wide, glabrous within, stamens (0.5–)0.7–1(–1.5) cm long, anthers 1–1.5(–1.75) mm long, receptacle 2–3(–4) mm long.

Distribution. Socotra.

2B. Maerua angolensis DC. (subsp. *socotrana*) var. **africana** Kers, var. nov. TYPE: Ethiopia. Ogaden: Lamaloye, 7 July 1988, *C. F. Hemming 1517* (holotype, K).

Sepalis 1.2–2.2 cm longis, 3–6 mm latis, intus glabris vel puberulis, staminibus 1.5–2.4 cm longis, antheris 1.5–2.5 mm longis, receptaculo 2–6 mm longo. Haec varietas plantas plus-minusque intermedias inter subsp. *angolensem* et var. *socotram* includit.

Maerua angolensis var. *africana* differs from variety *socotrana* in the somewhat bigger flowers with sepals 1.2–2.2 cm long and 3–6 mm wide, glabrous or puberulous within. Stamens 1.5–2.4 cm long and with anthers 1.5–2.5 mm long. The receptacle is 2–6 mm long.

The occurrence of variety *africana* is split into a number of more or less isolated local forms, in some localities rather intermediate between subspecies *angolensis* and subspecies *socotrana* var. *socotrana.*

Distribution. Eastern Ethiopia and Somalia.

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A New Species of Nematopoid *Xyris* (Xyridaceae) from the Araracuara Area of Colombia

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ABSTRACT. A new species of *Xyris* (sect. *Nematopus*) has been discovered in the Caquetá basin east of Araracuara, Dept. Caquetá in the Colombian Amazon area. *Xyris trachysperma* is described, illustrated, and discussed as to its relationships with other taxa of the section. The affinities of *X. trachysperma* appear to be more with species of planaltan Brazil than with those of the Guayana Highlands.

During integrated surveys by personnel of the Tropenbos Program of the forest and soils of the Caquetá basin east of Araracuara, Dept. Caquetá, in the Colombian Amazon area, J. Duivenvoorden and associates visited and collected plants in the savanna complexes of a sandstone meseta (350 m a.s.l.) near Araracuara in 1988 and 1990. This region of Colombia has long been known to be rich in Xyridaceae: its lowland and upland savannas produce a wealth of species shared with the Orinoco and Río Negro systems of Colombia and contiguous Venezuela and also some unshared endemics. The Araracuara area has had a fairly long history of plant exploration, most of it originating with R. E. Schultes, H. García-Barriga, and associates in the 1950s, and subsequently by B. Maguire and associates in the 1950s and 1960s, resulting in the discovery of several novelties, three from Río Caquetá savannas. Yet these systems are so large and so complex that the potential for further discoveries continues. Therefore, when a large set of collections from this place was sent from Tropenbos to VDB for definitive study, one *Xyris* attracted particular attention. A full description of it is provided to emphasize that its affinities are, surprisingly, more with species of planaltan Brazil rather than with its Colombian or Venezuelan cohabitants.

Xyris trachysperma Kral & Duivenvoorden, sp. nov. TYPE: Colombia. Dept. Caquetá: Araracuara (0°37′S, 72°24′W), sobre la mesa de areniscas de la base militar, 18 Oct. 1990, *Joost Duivenvoorden & A. Cleef 306* (holotype, Herbario Amazónico; isotype, VDB). Figure 1a–n.

Xyris trachysperma, species nova: a *X. bialata* Malme foliis et scapis ciliatis, bracteis fertilibus minute rufociliatis, a *X. melanovaginata* Kral caulibus brevioribus, scapis bialatis, areis dorsalibus distinctibus, et ab ambobus seminibus paucis (2–4), cupiformis, 1.3–1.4 mm longis, grosse papillatis bitruncatis, bi-umbilicatis, apicibus anguste apiculatis, placentatio basalis differt.

Sturdy caespitose perennial to 75 cm high, roots fibrous, somewhat coarse. Stems short, to 4 cm. Leaves flabellately spreading, the principal ones 40–60 cm long, longer than the scape sheaths; sheaths entire, ecarinate at base, carinate above it, lustrous brown or dark red-brown, the keel a deep shining red-brown, often rusty-ciliolate, the sides abruptly, then gradually narrowing to a short-ligulate apex; blades elliptic-linear, 3–4 times longer than the sheaths, 5–10.1 mm wide, flat, olivaceous, with several broad, low nerves, the surfaces finely papillose; tips abruptly incurved-acute, densely red-ciliate; margins with a narrow, deep, red-brown, incrassate, lustrous, entire to intermittently rusty-ciliolate border. Scapes gradually widening from base upward, broadly bi-alate, distally to 6 mm wide, green, slightly thickened and rusty-ciliolate at margin, the sheaths angulate, short-bladed. Spikes narrowly ellipsoid or cylindric, 1.5–2.5 cm long, obtuse, many-flowered; sterile bracts 2 pairs, decussate, the lower pair triangular, strongly carinate, 3–5 mm long, the carinas ciliolate, the inner pair obovate, ca. 3–3.5 mm long; fertile bracts broadly ovate to broadly elliptic, 6–7 mm long, convex, ecarinate, at anthesis with a light brown matrix, reddish brown, with margin rusty fimbriolate and with the dorsal areas ovate or broadly elliptic, green, with costa indistinctly antrorsely arcuately branched. Flowers with lateral sepals free, curved, inequilateral, ca. 6 mm long, acute to acuminate; keel broad, rusty-

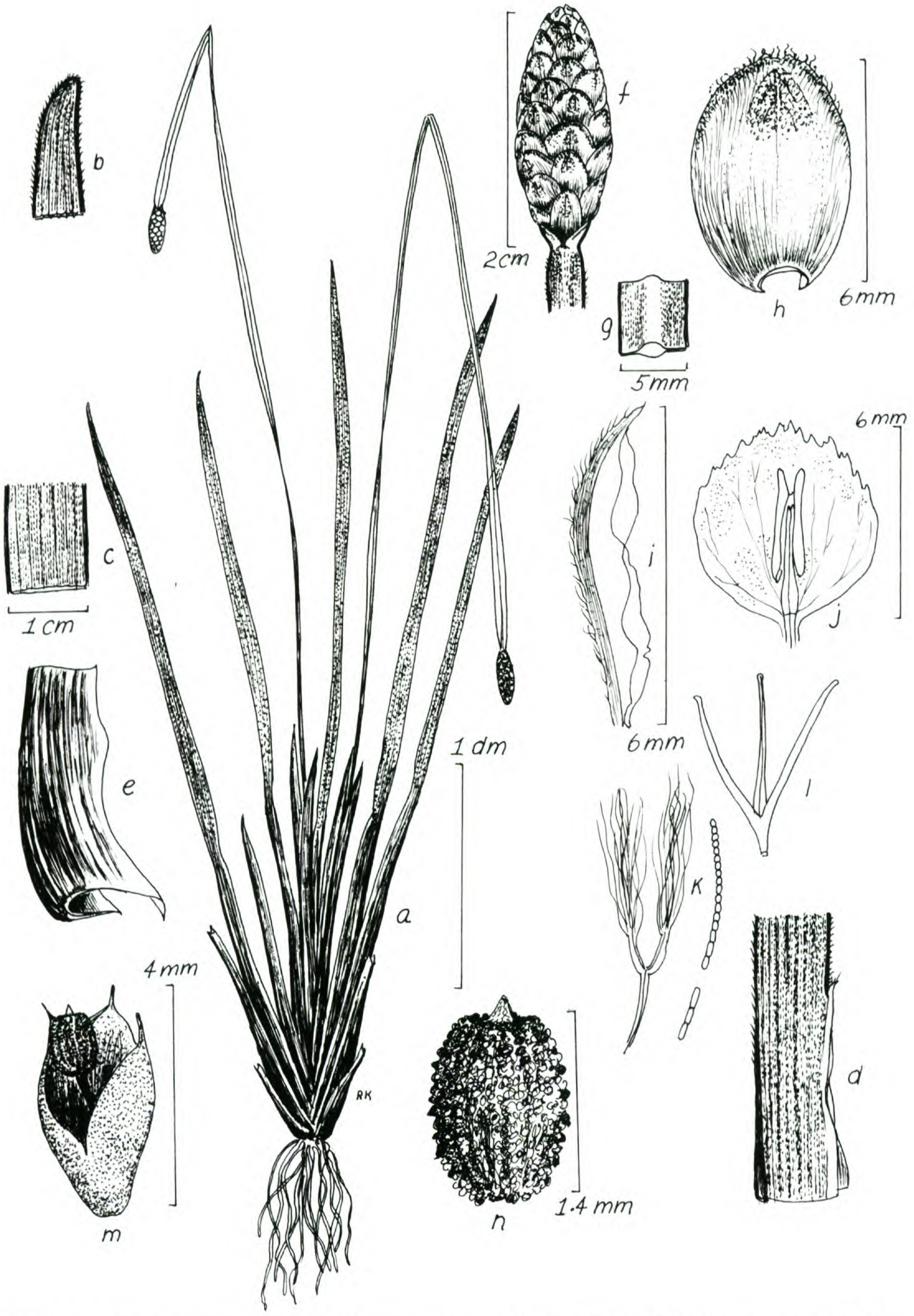

Figure 1. *Xyris trachysperma* Kral & Duivenvoorden. —a. Habit sketch. —b. Leaf apex. —c. Leaf blade, midsector. —d. Leaf blade–sheath junction. —e. Leaf base. —f. Spike. —g. Scape sector. —h. Fertile bract. —i. Lateral sepal. —j. Petal blade, stamen. —k. Staminode (left) and enlarged beard hair (right). —l. Stylar apex. —m. Dehisced capsule showing one seed on elongate funiculus. —n. Seed.

ciliate. Petals with blades orbicular, light yellow, ca. 6 mm long, apically lacerate. Staminodia 2-branched, the branches densely long-penicillate. Anthers oblong, 2.5 mm long, deeply bifid, slightly sagittate; filaments terete, 1.5–2 mm long. Capsule obovoid, 3–4 mm long, acuminate; placentation basal with elongate-clavate funicles. Seeds few (2–4), barrel-shaped, 1.3–1.4 mm long, dark dull brown, coarsely papillate or tuberculate, obscurely coarsely ribbed, the ends truncate-umbilicate, the apex narrowly apiculate.

This species is one of the most distinctive of American *Xyris*, primarily because of its unique seed form and sculpture. An attempt to align it with some previous large treatments of South American *Xyris*, such as those by Idrobo (1954), Maguire & L. B. Smith (1964), L. B. Smith & R. J. Downs (1968), or myself (1988), would place it, as to general characters, nearest *X. melanovaginata* Kral & Lyman B. Smith of the high tepuis of Bolívar, Venezuela, or *X. bialata* Malme far to the southeast in the Brazilian planalto. Both of these are likewise sturdy, with similarly pigmented foliage, leaves in fans, with strongly broadened scapes, and with similar spikes, fertile bracts, and sepals. However, *X. melanovaginata*, while displaying similar leaves and remarkably similar spike outlines, has much longer stems; its broad scapes, while compressed, are not bi-alate; its spike bracts lack dorsal areas. Also, and perhaps most importantly, placentation in *X. melanovaginata* is distinctly axile. On the other hand, the Brazilian *X. bialata* comes nearest overall, even though it occurs far to the southeast. It combines a short stem, broadly bi-alate scapes, and fertile bracts with distinct dorsal areas; its placentation is of the central type. Such features thus, in a general treatment, align it most closely with *X. trachysperma*, which is nonetheless separated by its ciliate leaf blades and scapes, its narrower spikes, its ciliolate bract edges, its basal (rather than free-central) placentation, and particularly by its fewer, larger, and distinctive seeds.

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A New Name for an Indian *Memecylon* (Melastomataceae)

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ABSTRACT. A new name, *Memecylon balakrishnanii*, is proposed for a species of *Memecylon* described by Balakrishnan & Nair.

Balakrishnan & Nair (1983) described the new species *Memecylon collinum* from Saddle Peak, North Andaman Island, India (holotype, *N. P. Balakrishnan & N. G. Nair 4764 A*, CAL; isotypes, *4764 B–D*, PBL). The name is occupied by *M. collinum* Jacques-Félix (1979) from Gabon and Cameroon (holotype, *N. Halle 3587*, P). Thus, *M. collinum* N. P. Balakrishnan & N. G. Nair is a later homonym and illegitimate. A new name is required for the species described by Balakrishnan and Nair (*ICBN*, Art. 64.1; Greuter et al., 1988). This species is renamed after N. P. Balakrishnan, for his outstanding contributions to plant systematics in India.

Memecylon balakrishnanii P. Lakshminarasimhan & S. P. Mathew, nom. nov. *Memecylon collinum* N. P. Balakrishnan & N. G. Nair, Bull. Bot. Surv. India 24: 30. 1982 [1983], *not* H. Jacques-Félix 1979: 420.

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New Species of *Manettia* (Rubiaceae) from Mesoamerica

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ABSTRACT. Three new species of *Manettia* (Rubiaceae) are described from Panama: *M. arboricola*, *M. microphylla*, and *M. longicalycina*.

Manettia Mutis ex L. (Rubiaceae) is a genus of herbaceous or somewhat woody, usually twining vines distributed in the West Indies, Mexico, Central America, and South America south to subtropical Argentina and Paraguay. Comprising an estimated 80–130 species, this genus was revised by Wernham (1918, 1919) and treated for Central America and Mexico in the *North American Flora* (Standley, 1921), *Flora of Guatemala* (Standley & Williams, 1975), and *Flora of Panama* (Dwyer, 1980). Although two papers on the classification of *Manettia* were published by Chung (1967, 1968), no recent comprehensive accounts of the genus exist.

Traditionally, *Manettia* has been placed in the *Cinchoneae* (de Candolle, 1830; Schumann, 1889; Steyermark, 1974; Robbrecht, 1988), on account of its dry fruits with numerous ovules per locule and winged seeds. Because *Manettia* contains raphides, Bremekamp (1966) and Verdcourt (1958) removed it from *Cinchoneae* and placed it in *Hedyotideae*, an option also mentioned by Robbrecht (1988).

In a recent cladistic study of *Cinchoneae* incorporating cpDNA data and other information, Andersson & Persson (1991) suggested that the presence or absence of raphides in Rubiaceae is not as important a character as previously thought. Andersson and Persson placed *Manettia* in *Hedyotideae* in the same clade as *Bouvardia*, *Hedyotis*, and *Hindsia*, based on shared characters of distinct placentas attached centrally by a stipe, testal outgrowth forming a concentric wing, wood having fiber tracheids and predominantly solitary vessels, and loculicidal capsules dehiscent only at the apex.

During the course of preparing a treatment of *Manettia* for *Flora Mesoamericana*, three new species—all from Panama—came to light and are described below. Most interesting are the two hemiepiphytic species, *M. arboricola* Lorence and *M. microphylla* Lorence & Dwyer, which climb up tree trunks by means of adventitious roots, an unusual feature previously unreported in the genus. These species are otherwise characteristic of *Manettia* in terms of their flower, capsule, and seed morphology.

1. Manettia arboricola Lorence, sp. nov. TYPE: Panama. Comarca de San Blas: El Llano–Cartí Road, km 16.7, 350 m, 9°19′N, 78°55′W, 16 June 1985, *G. de Nevers & S. Charnley 5907* (holotype, MO 3623655, photo, PTBG; isotypes, F, SCZ). Figure 1.

Species non volubili hemiepiphyto habitu, radicibus adventitiis, inflorescentia terminali in ramis frondosis disposita, floribus 3–5, corolla caerulea, tubo gracili 0.5–0.6 mm in diametro distinguibilis.

Hemiepiphytic vine ascending tree trunk, the main stem woody, 1.5–2 mm diam., the bark brownish white, peeling, adventitious roots produced at nodes, the primary branches 10–23 cm long, arising at nodes, sparsely branching again, the secondary branches 4–10 cm long, 1 mm diam., usually leafy and terminated by a single inflorescence, the internodes 1–3 mm long, each side with a longitudinal ridge flanked by 2 furrows, smooth, glabrous, whitish; leaves petiolate, the petioles 2–6 × 0.5 mm, glabrous; lamina ovate, 2.5–5 × 1–2.5 cm, the base cuneate or rounded, the apex acute, glabrous, drying dark brownish green, chartaceous or membranaceous, the 2° veins 4–6 pairs, arcuate, weakly brochidodromous; stipules narrowly deltoid, 0.5 mm long, thickened. Inflorescence terminal, glabrous, cymose, 3–5-flowered, the peduncle 10–13 mm long; flowers 4-merous, the pedicels 4–10 × 0.2–0.3 mm, bracteolate, the bracteoles subulate, 1 mm long, the hypanthium obovoid-turbinate, 1.5–2 × 1–1.2 mm, glabrous; corolla blue when fresh, salverform, the tube 8–9 mm long, 0.5–0.6 mm diam., glabrous externally and internally, the lobes narrowly lanceolate-elliptic, 7–8 × 1.5–2 mm, glabrous; stamens included, affixed 2 mm below throat, the anthers 1.5 mm long, linear-ellipsoid; style 1.5 mm long, the stigma bilobed, the lobes linear, 0.5 mm

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Figure 1. *Manettia arboricola* Lorence. *De Nevers & Charnley 5907* (holotype, MO).

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Figure 2. *Manettia microphylla* Lorence & Dwyer. *McPherson 12189* (holotype, MO).

long. Capsules obovoid-subglobose, 5–7 × 5–7 mm, weakly 8–10-ribbed, glabrous, brown; seeds 1.4–1.6 mm diam., subcircular, the center dark brown, 0.6–0.7 mm diam., the wing scarious, the testa cells radiate, elongate, the margin irregularly erose-fimbriate.

Distribution. Panama, known from the Cerro Tacarcuna in the Darién Province and from the type locality in the Comarca de San Blas.

Habitat. Manettia arboricola occurs in tropical wet forest and premontane wet forest from about 350 to 1,300 m. Flowering and fruiting specimens were collected in January, February, and June.

Manettia arboricola is most closely allied to *M. microphylla* (described below), a species with much smaller leaves and fruits and solitary flowers. Both species display the same specialized hemiepiphytic habit, are characterized by nontwining stems with adventitious roots, and have corollas that are glabrous in the throat. The blue corollas of *M. arboricola* are also unusual within the genus.

Paratypes. PANAMA. DARIEN: Cerro Tacarcuna, trail from Tacarcuna Village on Río Tacarcuna to Cerro Mali, 800–1,300 m, *A. Gentry & S. Mori 13616* (MO); trail from Río Pucuro base camp up W ridge of Cerro Mali, 640–1,000 m, *A. Gentry & S. Mori 14167* (MO).

2. Manettia microphylla Lorence & Dwyer, sp. nov. TYPE: Panama. Darién: Pirre Massif, Alturas de Nique, above Cana mine, 7°45′N, 77°40′W, 850–1,150 m, 2 Mar. 1988, *McPherson 12189* (holotype, MO 3648261, photo, PTBG; isotypes, F, PTBG). Figure 2.

Species non volubili hemiepiphyto habitu, radicibus adventitiis, foliis microphyllis, lamina elliptica vel ovato-elliptica, 5–10 mm longa, 3–5.5 mm lata, petiolis 1–2 mm longis, capsulis parvis solitariis terminalibusque distinguibilis.

Hemiepiphytic vine ascending tree trunk, the main stem woody, 3–4 mm diam., the bark brownish white, peeling, adventitious roots produced at nodes, the primary branches produced irregularly from nodes, (5–)10–40 cm long, 0.5–1 mm diam., sparsely to profusely branched again, the secondary branches 2–8 cm long, usually leafy and terminated by a single fruit, the internodes 4–7 mm long, whitish, each side with a longitudinal ridge flanked by 2 furrows, moderately hirtellous, the hairs 0.1–0.2 mm long, white, antrorse, unicellular; leaves appearing distichous (actually decussate), petiolate; petioles 1–2 × 0.2 mm, sparsely hirtellous; lamina elliptic or ovate-elliptic, 6–10 × 3–5.5 mm, the

base cuneate or rarely attenuate, the apex acute or rounded, drying dark greenish or blackish brown (in alcohol-treated specimens), chartaceous, adaxially glabrous, abaxially strigillose along costa and with numerous prominent white raphides oriented parallel to veins, the 2° veins 3(–4) pairs, arcuate, weakly brochidodromous; stipules narrowly deltoid, 0.2–0.3 mm long, glabrous, compressed, the tip thickened. Mature flowers unknown; immature flower in bud on pedicel 0.3 mm long, the hypanthium obovoid, 1 × 0.7 mm, compressed, glabrous, the calyx cup 0.15 mm deep, the lobes 4, narrowly deltoid or subulate, 0.8–1.1 × 0.2–0.3 mm; immature corolla in bud ca. 1 mm long, glabrous externally and internally. Fruits solitary, terminal, pedicellate, the pedicel 2–4 mm long, slender, bracteolate, the bracteoles narrowly subulate, ca. 1 mm long; capsule subglobose, 3–5 × 3–5 mm, slightly bisulcate, slightly compressed, weakly 6-ribbed, crowned by a low, bilobed disc, and 4 narrowly deltoid or subulate calyx lobes 1.2–1.5 × 0.4–0.5 mm, glabrous, raphides conspicuous; seeds subcircular, 1–1.3 mm diam., the center dark brown, 0.4–0.5 mm diam., the wing light brown, the testa cells long, radiating, the margin irregularly erose-fimbriate.

Distribution. Known only from the type locality, approximately 14–15 km north of the Alturas de Nique on the Panamanian–Colombian border.

Habitat. Tropical wet forest, at 850–1,150 m altitude. The type collection was fruiting in March.

Manettia microphylla is undoubtedly most closely related to *M. arboricola*, as both species share the nontwining, hemiepiphytic habit, have adventitious roots, similar stipule and seed morphology, terminal inflorescences on leafy shoots, and internally glabrous corollas. The latter species differs in having much larger leaves (25–50 × 10–25 mm), larger fruits 5–7 mm long and wide, and 3–5-flowered cymes. *Manettia microphylla* represents an extremely reduced and specialized species adapted to hemiepiphytism, growing closely appressed to tree trunks.

Figure 3. *Manettia longicalycina* Dwyer & Lorence. *Folsom & Jaslon 2665* (holotype, MO).

3. Manettia longicalycina Dwyer & Lorence, sp. nov. TYPE: Panama. Coclé: Alto Calvario, cloud forest, 800–900 m, 20 Apr. 1977, *J. P. Folsom & A. Jaslon 2665* (holotype, MO 3608777, photo, PTBG). Figure 3.

Species *Manettiae reclinatae* L. affinis, floribus in pedicellis brevibus (1–)3–5 mm longis, calycis lobis longioribus lineari-lanceolatis vel lineari-subulatis, 5–12 mm longis, corolla alba vel rosea differt.

Dextrorsely twining herbaceous vine, the young stems quadrangular, the mature stems cylindrical, 2–3 mm diam., with 4 low wings 0.2–0.3 mm wide, densely retrorsely hirtellous especially on wings. Leaves petiolate; petioles 2–10(–17) × 0.5–1 mm, sparsely villosulous or strigillose; lamina ovate or ovate-elliptic, (1.5–)2.5–9.5 × (1–)2–6 cm, the base rounded or obtuse, the apex acuminate, the acumen (2–)5–15 mm long, chartaceous or subcoriaceous, drying green or blackish green, the 2° veins 4–5 pairs, arcuate, the venation visible to 2° or 3° on both surfaces; stipules broadly obtuse or semicircular, 0.5–1 × 3–4 mm, spreading or reflexed, glabrous, the margins bearing a fringe of thick, conical, pale brown colleters 0.3 mm long. Flowers axillary, solitary or in cymes of 2–5, or in axillary leafy inflorescences 2–2.5 cm long, the pedicels and peduncles with a pair of subulate bracetoles 2–3 mm long, the peduncle 1–2 mm long; flowers on pedicels (1–)3–5 mm long, 0.5 mm diam., strigillose-hirtellous, the hypanthium obconical, 2–3 × 2 mm, compressed, hirtellous, the calyx cup 0.5–0.6 mm deep, the lobes 8 or occasionally 6, linear-lanceolate to linear-subulate, 5–9(–12) × 0.5–1 mm, strigillose-hirtellous or glabrate, erect-spreading, each sinus with 3–4 small, brown colleters; corolla white or pink when fresh, salverform, the tube 11–16 mm long, 2–2.5 mm wide medially,

externally sparsely hirtellous, internally with a white villous ring just above middle or glabrous, the throat barbate with villous yellow trichomes, the lobes elliptic, 4–7 × 2–2.5 mm, the apex acute, usually spreading 45°, occasionally with hirtellous or fringed margins; stamens affixed 1–2 mm (thrum) or 6–7 mm (pin) below throat, anthers linear, 2.5–3 mm long, included in tube or tips exserted; style glabrous, 6–9 mm (thrum) or 13 mm (pin) long. Capsules broadly obovoid or obcordiform, strongly compressed, bisulcate, 5–7 mm long and wide, glabrate or hirtellous, venose, the pedicels 5–7 mm long; seeds subcircular, 2–3 mm diam., the dark brown center 1 mm diam., the wing 0.6–1 mm wide, brown, the testa cells radiate, elongate, the margin erose-laciniate.

Distribution. Manettia longicalycina is known only from Panama, where it has been collected on the Atlantic slope in the Provinces of Coclé (Alto Calvario, La Mesa, El Valle Mesa, El Copé, and between Cerro Pilón and El Valle de Antón), Panamá (Cerro Campana, and between Cerro Azul and Cerro Jefe), and Veraguas (Escuela Agrícola Alto Piedra).

Habitat. This new species occurs in tropical wet forest and cloud forest from about 700 to 1,300 m elevation, where it grows in disturbed sites or clearings. Flowering specimens were collected in April–July, September, and October, and fruiting specimens in January, April–October, and December.

Manettia longicalycina appears to be most closely allied to *M. reclinata* L., from which it differs by the characters given in the diagnosis. This new species is also closely related to an undescribed species from Costa Rica (C. M. Taylor, pers. comm.) characterized by its much longer peduncles 10–25 mm long and pedicels 10–25 mm long, (6–)8-merous flowers, and corollas with a shorter tube 6–10 mm long and lobes 3–4 mm long. *Manettia longicalycina* typically has white or less frequently pink corollas. However, a single collection from the Canal Zone [Fort Sherman Site, U.S. Army Tropic Test Center, *J. D. Dwyer 8595*, MO] was said to have dull purple-red flowers. In addition to the anomalous flower color, this collection occurs in the wrong climatic zone and at an atypically low altitude for the species, a little above sea level. Its taxonomic status is therefore doubtful.

Paratypes. PANAMA. COCLE: between Cerro Pilón and El Valle de Antón, 700–900 m, *J. A. Duke & J. D. Dwyer* (MO); La Mesa, 2 km W of Cerro Pilón, 900 m, *G. A. Sullivan 509* (MO, US); 7 km N of El Copé, near Rivera sawmill, 700–850 m, *J. P. Folsom 5230* (MO); 2.2 km beyond sawmill in forest along lumber road above El Copé, 900 m, *B. Hammel 992* (MO); El Copé on Pacific side, ½-hour walk from sawmill, 2,600 ft., *T. Antonio 2060* (MO); above El Potroso sawmill at Continental Divide, N of El Copé, *K. Sytsma & L. Andersson 4567* (MO); sawmill above El Copé, along stream E of sawmill, 2,300 ft., *B. Hammel 4080* (MO); above sawmill above El Copé, 1,000 m, *J. S. Miller et al. 824A* (MO); 7 km N of El Copé, Alto Calvario, 700–850 m, *J. P. Folsom et al. 5732* (MO); El Valle Mesa, 5.6 km along Mesa road from main road in El Valle, 700–800 m, *J. P. Folsom 3891.Z* (MO); La Mesa, above El Valle de Antón, ca. 2 km W of Cerro Pilón, 900–930 m, *T. B. Croat 37483* (MO). PANAMA: Cerro Campana, *R. L. Dressler 3524* (MO), 780–875 m, *T. B. Croat 25190* (MO), 2,600–2,800 ft., *J. D. Dwyer 1922* (MO), 850 m, *J. S. Miller et al. 769* (MO); between Cerro Azul and Cerro Jefe, *R. L. Dressler 3248* (MO). VERAGUAS: 0.2 mi. beyond fork in road at Escuela Agrícola Alto Piedra on road to Río Calovébora, 750 m, *T. B. Croat & J. P. Folsom 33899* (MO).

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A New Species of *Ardisia* (Myrsinaceae) from Madagascar

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ABSTRACT. Recent exploration in the Marojejy Natural Reserve has resulted in the discovery of a new species, *Ardisia* (subg. *Akosmos*) *marojejyensis*. The species is described and illustrated, and its phylogenetic relationships are discussed. A key to distinguish the three known Madagascan species of *Ardisia* is provided, and subgenus *Madardisia* is relegated to synonymy under subgenus *Akosmos*.

The Réserve Naturelle Intégrale de Marojejy (number 12) comprises 60,150 hectares of wet, tropical forests that range from ca. 100 to 2,137 m in elevation (Jenkins, 1987). Henri Humbert botanized extensively in the region and made approximately 3,000 collections, many of which were species new to science (Humbert, 1955). Humbert's efforts were undoubtedly one of the factors drawing interest to the rich, largely endemic flora and leading to the declaration of the area as a reserve in 1952. Despite the efforts of Humbert and botanists who have since continued collecting in the reserve, the flora remains poorly known and continues to yield novelties. Recent estimates (Miller, ined.) indicate that the flora of the reserve contains about 2,000 species, perhaps 20% of the total flora of the country. Collecting efforts in the southern part of the reserve in February 1989 have yielded a previously undescribed species of *Ardisia* Swartz (Myrsinaceae), only the third reported for Madagascar.

Ardisia (subg. *Akosmos*) **marojejyensis** James S. Miller & Pipoly, sp. nov. TYPE: Madagascar. Antsiranana: Réserve Naturelle Intégrale de Marojejy, along the trail to the summit of Marojejy Est, NW of Mandena, wet, evergreen forest above the second camp, 700–850 m, 14°26′S, 49°16′E, 10 Feb. 1989 (fl), *James S. Miller & P. P. Lowry 3936* (holoytpe, MO 4064879; isotypes, K, P, TAN, US). Figure 1.

Arbor ad 15 m alta. Folia persistentia; lamina obovata, 18–28 cm longa, 8–12 cm lata, apice late obtuso ad rotundato, basi cuneata ad obtusa; petiolo 3–5 cm longo. Flores pedicellis 1–2 mm longis inserti, sepalis 1.7–2 mm longis, petalis 4–5 mm longis, antheris 2.5–3 mm longis, stylo ca. 3 mm longo. Fructus nobis non visus.

Tree 10–15 m tall; branchlets terete, 1–1.5 cm diam., densely furfuraceous-lepidote, the scales so densely packed as to form an apparent sheet, later breaking up and somewhat glabrescent. Leaves persistent; lamina carnose when fresh, drying coriaceous, obovate, 18–28 cm long, 8–12 cm wide, the apex widely obtuse to rounded, the base cuneate to obtuse, decurrent on the petiole, midrib depressed above, prominently raised and black punctate-lineate below, the secondary veins 35–40 pairs, 0.5–1 cm apart, inconspicuously pellucid punctate, glabrous above and below; petiole marginate, 3–5 cm long, densely furfuraceous-lepidote, glabrescent. Inflorescences clustered near the apices of branches, internodal, erect, paniculate, the rachis 15–30 cm long, the lateral branches 5–10 cm long, glabrous or nearly so. Flowers bisexual, borne on pedicels 1–2 mm long; buds ovoid to conical; sepals 5, quincuncial, greenish white, ovate, 1.7–2 mm long, glabrous, sparsely pellucid punctate, the margin scarious, hyaline, glabrous; petals 5, quincuncial, bright pink, basally connate, ovate to narrowly ovate, 4–5 mm long, 1.5–2 mm wide, apex acute, symmetric, prominently pellucid punctate, the margin irregular, entire, glabrous; stamens 5, the filaments 0.2–0.4 mm long, basally adnate to the petals, free from each other, the anthers bright yellow, lanceoloid, 2.5–3 mm long, apex long-apiculate, base cordate, dehiscing first by apical pores, then narrow, longitudinal slits, the connective conspicuously brown punctate dorsally; ovary ovoid, 0.5–1 mm long, the placenta depressed-globose, 0.4–0.6 mm long, 0.6–0.8 mm diam., apex apiculate, the ovules 4, biseriate, the style ca. 3 mm long, the stigma punctiform. Fruit unknown.

Local names: "Talandoha" (near Mandena); "Maimbola" (Ambatosoratra).

Ardisia marojejyensis is a spectacular, apparently mass-flowering tree, covered with pink flowers, making it easily visible from a distance. It is uncommon in the reserve at middle elevations, and few individuals were seen even though all in a given valley can easily be counted. Because this species appears to mass flower (all individuals flower synchronously in a short period of time), it is probable that it has been missed by previous collectors purely

Figure 1. *Ardesia marojejyensis* James S. Miller & Pipoly. —A. Flowering branch, showing erect, pyramidal panicles with racemose branches. —B. Section of the inflorescence showing conical buds and open flowers. —C. Anthers showing apical pores and longitudinal slits. —D. Longisection of ovary showing placenta and biseriate ovules. Drawn from *Miller & Lowry 3936*.

by chance. However, when it was recently collected, the senior author noted it was a conspicuous element of the forest, and many individuals were readily visible from most vantage points.

Paratype. MADAGASCAR. ANTSIRANANA: Réserve Naturelle Intégrale de Marojejy, N slopes of Ambatosoratra, wet montane forest on steep slopes, 700–900 m, 14°32′S, 49°41′E, 24 Feb. 1989 (fl), *James S. Miller 4196* (MO, TAN).

KEY TO THE SPECIES OF *ARDISIA* IN MADAGASCAR

1a. Leaves 6–16 cm long; inflorescences umbelliform, long-pedunculate; anthers dehiscent by terminal pores; plants of western forests . . . . . *A. didymopora* (H. Perrier) Taton

1b. Leaves 18–40 cm long; inflorescences racemose or corymbose, in pyramidal panicles; anthers dehiscent by terminal pores, then narrow, longitudinal slits; plants of eastern forests.

2a. Leaves borne on petioles 3–5 cm long; panicles erect, pyramidal, the branches racemose; pedicels 1–2 mm long; petals 4–5 mm long, the apices acute . . . . . *A. marojejyensis* James S. Miller & Pipoly

2b. Leaves sessile or nearly so; panicles pendent, columnar, the branches corymbose; pedicels 10–20 mm long; petals 10–11 mm long, the apices abruptly acuminate-caudate . . . . . *A. procera* Capuron

Ardisia marojejyensis appears closely related to *A. procera* Capuron, another species from the wet forests of northeastern Madagascar. The paniculate inflorescences subequal to the leaves with racemose branches and long peduncles, the slightly curved style subequal to the petals, punctiform stigma, and anthers with first poricidal, then longitudinal dehiscence, clearly indicate that both species are members of subgenus *Akosmos* Mez. Subgenus *Akosmos* was thought to have its center of diversity in subtropical central Asia and eastern Asia (Mez, 1902), but recent studies by Stone (1989, 1990) indicate its center of diversity lies in the Malesian region. Capuron (1963) placed *Ardisia procera* in his new subgenus *Madardisia*, which we consider a taxonomic synonym of subgenus *Akosmos*. In comparing the descriptions of the subgenera, we have found that the principal difference was the fact that Capuron considered *Madardisia* to have strictly poricidal anther dehiscence, while Mez (1902) indicated that *Akosmos* had longitudinal anther dehiscence. Our examination of representative species of *Ardisia* subg. *Akosmos* from Madagascar, central tropical Asia, eastern subtropical Asia, and Malesia indicates that the anthers in many species open first by conspicuous or inconspicuous pores (terminal or subterminal), then by longitudinal slits. Failure to understand this morphogenetic process led Mez and Capuron to have incomplete concepts of the group. Therefore, the fact that two of the three *Ardisia* species thus far known from Madagascar belong to subgenus *Akosmos* is phytogeographically interesting. We hope that further collection in Madagascar and in the Malesian region will help the current dearth of knowledge on the population biology of these species.

Ardisia procera and *A. marojejyensis* are similar in general aspect and occur in similar forest types. However, *Ardisia marojejyensis* differs from *A. procera* in having leaves borne on marginate petioles 3–5 cm long, erect pyramidal panicles with racemose branches, and smaller flowers on short (1–2 mm) pedicels. Capuron (1963) described *A. procera* as deciduous, but this appears to be either the result of his describing a western dry forest race (or ecotype) formation, or an error. *Ardisia marojejyensis* certainly appears to have persistent foliage, and *A. procera*, also from a high-rainfall region, is most probably evergreen as well, at least in the rainforest zone. On the other hand, the other Madagascan species of the genus, *Ardisia didymopora* (H. Perrier) Taton, from dry regions in the west, is clearly deciduous.

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Tapirira obtusa comb. nov. (Anacardiaceae)

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ABSTRACT. The discovery that one of the syntypes cited by Engler under the name *Tapirira marchandii* is also the type for an earlier, validly published name, *Mauria obtusa* Bentham, necessitates the transfer of *Mauria obtusa* to *Tapirira*. The new combination *Tapirira obtusa* takes priority over *Tapirira marchandii* Engler.

A review of the literature and specimens of *Tapirira* (Anacardiaceae) has revealed the existence of an earlier name, which has priority over *Tapirira marchandii* Engler.

The specimen "*Schomburgk 892*" [= *Robert Schomburgk series II 892*] is included in the list of syntypes cited by Engler (1876) under the original description of *Tapirira marchandii*. This is the same specimen as one of the two syntypes mentioned by Bentham (1852) for his species, *Mauria obtusa*. Bentham described two other species of *Mauria* in the same article. Two of the species, *Mauria multiflora* C. Martius ex Bentham and *Mauria subbijuga* C. Martius ex Bentham, were later treated as synonyms of *Tapirira guianensis* Aublet by Engler (1876). However, Engler overlooked the third species of *Mauria*, *Mauria obtusa*, described by Bentham (1852: 16) in the same article. Later authors were also apparently unaware of Bentham's third *Mauria* species. The name *Mauria obtusa* is not listed in any of the editions of *Index Kewensis* or the *Gray Card Index*. In conclusion, the basionym *Mauria obtusa* has priority over the name *Tapirira marchandii*.

The syntypes of *Mauria obtusa*, *Robert Schomburgk II 892* and *Richard Schomburgk 1442*, clearly agree morphologically with the other syntypes listed by Engler under the name *Tapirira marchandii*. These syntypes evidently belong in the genus *Tapirira*, not *Mauria*, because they are unisexual, the petals are imbricate, and the staminate pistillode and the pistil are both crowned by five styles. This is the typical condition of the flowers of *Tapirira*. *Mauria*, on the other hand, has bisexual flowers with a valvate corolla and a single style crowned by three sessile stigmas.

Bentham (1852) wrote that he was aware of the affinity of his three taxa of *Mauria* to *Tapirira guianensis*. (He actually published *M. obtusa* as "*Mauria* (Tapirioides) *obtusa*.") He probably misplaced these three species in *Mauria* instead of in *Tapirira* because of the incorrect fruit description and illustration in Aublet (1775). Aublet included a fruit from a different plant family in his description and illustrations of *Tapirira guianensis*.

The following is my proposed new combination and synonymy.

Tapirira obtusa (Bentham) Mitchell, comb. nov.
Basionym: *Mauria obtusa* Bentham, Hookers J. Bot. Kew Gard. Misc. 4: 16. 1852. TYPE: Guyana, 1842–1843, *Robert Schomburgk II 892* (lectotype, designated here, K; isolectotype, NY). [*Richard Schomburgk 1442* was probably collected from the same plant.]

Tapirira pao-pombo Marchand var. *major* Marchand in Warming, Vidensk. Meddel. Dansk. Naturhist. Foren. Kjøbenhavn 15: 59. 1873. TYPE: Brazil. Minas Gerais: Lagoa Santa, *Warming s.n.* (syntypes, C).

Tapirira marchandii Engler in C. Martius, Fl. Bras. 12(2): 379. 1876. Based on *Tapirira pao-pombo* Marchand var. *major* Marchand.

Tapirira peckoltiana Engler in C. Martius, Fl. Bras. 12(2): 379. 1876. TYPE: Brazil. Rio de Janeiro: Canta Gallo, *Peckolt 348* (holotype, BR).

Tapirira pao-pombo var. *major* was placed in synonymy by Engler (1876) in his description of *Tapirira marchandii*. I agree with Barfod's (1987) taxonomic decision that *T. peckoltiana* and *T. marchandii* are the same species.

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Two New Mesoamerican Species and a New Combination in *Huperzia* (Lycopodiaceae)

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ABSTRACT. Two new species of Lycopodiaceae, *Huperzia mesoamericana* and *H. talamancana*, are described as a result of revision of material for the pteridophyte volume of *Flora Mesoamericana*. The relationship of *H. talamancana* to *H. crassa* is discussed. A new combination, *Huperzia curvifolia* var. *parvifolia*, is proposed.

Huperzia mesoamericana B. Øllgaard, sp. nov. TYPE: Panama. Chiriquí: Cerro Hornito, epiphyte, in cloud forest, 6,200 ft., 8 May 1978, *Hammel 3061* (holotype, MO). Figure 1.

Species *Huperziae taxifoliae* (Swartz) Trevisan verosimiliter affinis, a qua differt foliis surculorum basalium 12–15 × 4–5 mm, ellipticis usque ad late lanceolatis, obtusis usque ad late acutis, et foliis surculorum dense sporangiferorum 6–8 × 2.5–3 mm, late lanceolatis, planis vel fere planis.

Pendent, up to 25 cm long; shoots slightly and gradually tapering from ca. 20–30 mm diam. including leaves at the base to 10–15 mm in distal divisions; stems (excluding leaves) 2–3 mm thick at the base; leaves gradually modified, borne in irregular, alternating whorls of 3, covering the stem; leaves of basal divisions spreading to perpendicular, elliptic to broadly lanceolate, obtuse to broadly acute, 12–15 × 4–5 mm, almost flat, firmly herbaceous to subcoriaceous, somewhat shining, with slightly revolute, entire margins; leaves of middle and distal divisions gradually smaller, more acute, more arcuately ascending, flat, with flat or slightly revolute margins; leaves of fully sporangiate divisions 6–8 × 2.5–3 mm; sporangia 1.5–2 mm wide.

Huperzia mesoamericana grows as an epiphyte in cloud forests, from 1,300 to 2,050 m, and is endemic to Costa Rica and Panama. It is a very distinct species of uncertain taxonomic affinity. Because it is a pendent epiphyte with gradually heterophyllous shoots and rather wide leaves of firm texture, this species is referred tentatively to the *Huperzia taxifolia* group of Øllgaard (1987, 1989). It differs from *H. taxifolia* by the shorter growth and more compact aspect, by the elliptic to widely lanceolate leaves, 12–15 × 4–5 mm, with obtuse to broadly acute apices, in the basal divisions of the plant, and by the leaves of the densely sporangiate distal divisions 6–8 × 2.5–3 mm, widely lanceolate and flat, with flat or slightly revolute margins. In contrast, *H. taxifolia* has linear-lanceolate to lanceolate leaves, 14–23 × 2–3 mm, in the basal divisions, and the leaves of the densely sporangiate distal divisions 3–8 × 1–1.5(–2) mm, lanceolate or narrower, usually with a widened and somewhat clasping base, and a long, narrow, involute apex.

Paratypes. COSTA RICA. CARTAGO: San Mateo et le chemin de Guacimo au bord de la mer du Pacifique, *Brenes, A. M. s.n.* (NY). ALAJUELA–PUNTARENAS–GUANACASTE: Cordillera de Tilarán, Monteverde, 1,300–1,400 m, Aug. 1978, *Dryer 1618* (F). PUNTARENAS: Monteverde, Veracruz river valley S of Reserve, Pacific slope wet forest, 10°15′N, 84°46′W, 1,300–1,500 m, 22 Aug. 1986, *Haber ex Bello & Clagget 5367* (MO). PANAMA. CHIRIQUI: Cerro Colorado, 1,600 m, 9 Aug. 1984, *Schmalzel 1997* (MO); Cerro Colorado, 11.2 km along ridge road from main road to Escopeta, 1,700 m, 16 Aug. 1977, *Folsom 4873* (MO).

Huperzia talamancana B. Øllgaard, sp. nov. TYPE: Costa Rica. San José: Cordillera de Talamanca, Cerro de la Muerte, Pan American Highway at km 91, Ericaceae–Chusquea scrub, 3,000–3,300 m, 25 Aug. 1983, *Hickey 898* (holotype, AAU). Figure 2.

Species *Huperziae crassae* (Humboldt & Bonpland ex Willdenow) Rothmaler affinis, a qua differt surculis basalibus homoblasticis, foliis (6–)8–11 mm longis, (1.5–)2–3 mm latis, ascendentibus usque ad laxe imbricatis, abaxialiter epidermide laevi et saepe nitida, vel interdum cellulis paucis protrusis pustuliformibus, non pruinosis.

Erect from an ascending base, forming large clumps, sometimes up to 60 cm tall; shoots homoblastic, homophyllous, equally thick throughout or slightly tapering, 7–15(–25) mm diam. including leaves; stem (excluding leaves) 3–5 mm thick; leaves borne in crowded, irregular, alternating whorls of (4–)5–7, spreading to arcuately ascending or loosely imbricate, lanceolate, (6–)8–11 × 2–3 mm (leaves of distal divisions sometimes 1.5–2 mm wide), with an inconspicuous to prominent, often prominently decurrent basal swelling (air cavity), abaxially flat

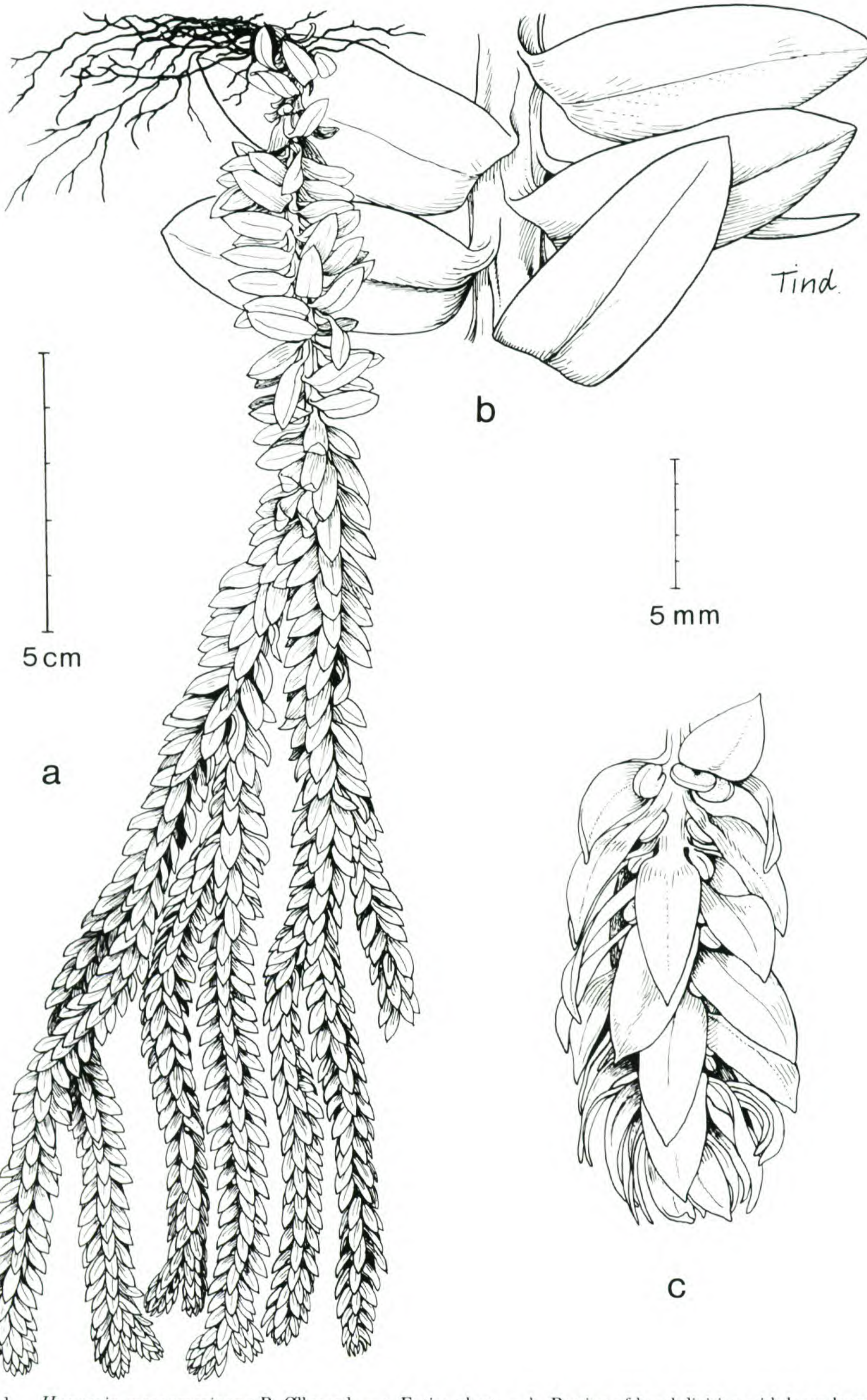

Figure 1. *Huperzia mesoamericana* B. Øllgaard —a. Entire plant. —b. Portion of basal division with large leaves. —c. Portion of distal, sporangiate division. (*Hammel 3061*, MO.)

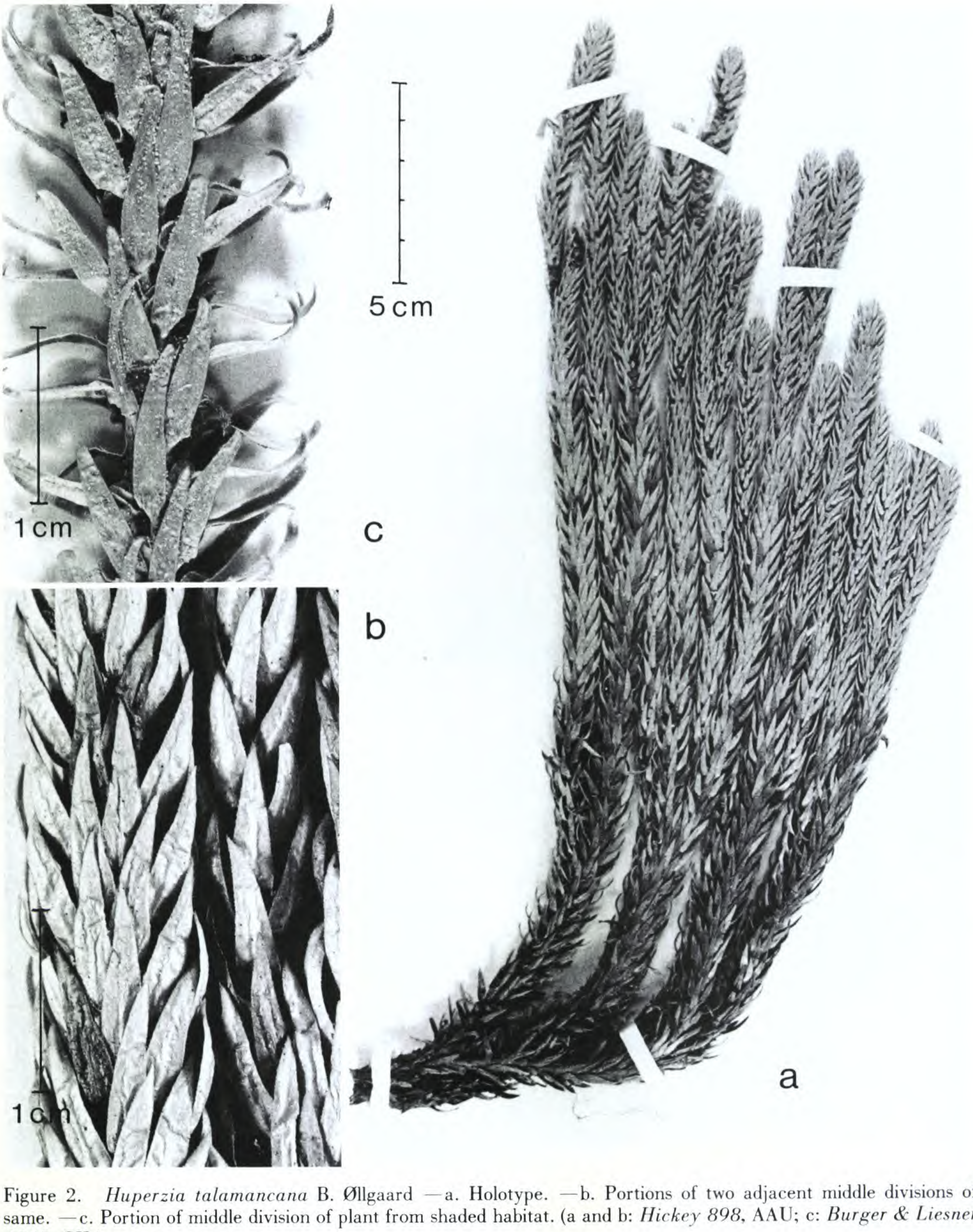

Figure 2. *Huperzia talamancana* B. Øllgaard —a. Holotype. —b. Portions of two adjacent middle divisions of same. —c. Portion of middle division of plant from shaded habitat. (a and b: *Hickey 898*, AAU; c: *Burger & Liesner 6349*, GH.)

to rounded or with a shallow central ridge, smooth and often shining, sometimes with a few inconspicuous, slightly protruding, blisterlike epidermal cells, with irregularly protruding, clear, marginal cells, green or yellowish tinged, not pruinous; sporangia 2–3 mm wide.

Huperzia talamancana grows as a terrestrial plant and under open scrub in páramo, in marshes and high swamps, often associated with *Sphagnum*. It appears to be rather frequent at high altitudes, mainly above 3,000 m in Costa Rica, and is known from two localities in western Panama. It belongs

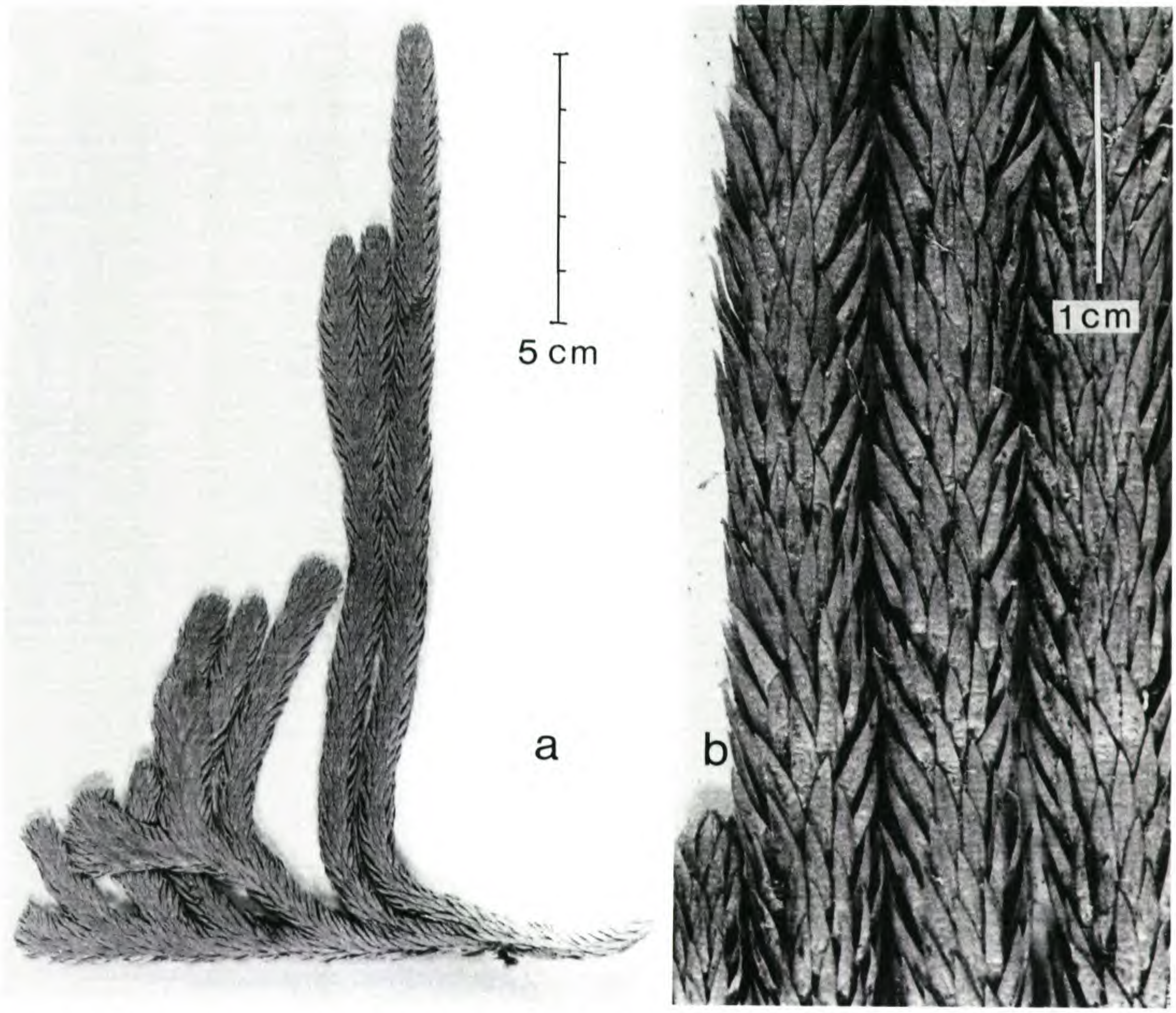

Figure 3. *Huperzia crassa* (Humboldt & Bonpland ex Willdenow) Rothmaler sens. lat. —a. Part of young plant with strongly heteroblastic basal divisions. —b. Portions of several middle divisions. (a: *Evans & Lellinger 143*, MO; b: *Davidse et al. 25941*, AAU.)

to the *Huperzia saururus* group (Øllgaard, 1987, 1989) and has commonly been included in a wide concept of *Huperzia saururus* (as *Lycopodium* or *Urostachys*); see, e.g., Lellinger (1989) and Rolleri (1977a, b, 1981). These authors emphasize similar features of specialized epidermal cells at the leaf margins. However, true *H. saururus*, as represented in the Andes from Peru to Argentina, besides Africa, differs from the present species in the strongly heteroblastic development of basal divisions, and the usually very tightly appressed leaves in the erect shoots. The erect shoots of *H. saururus* are densely aggregated and squeezed together at the base so that the lower leaves appear etiolated, and the horizontal divisions may have strongly reduced leaf development.

In herbaria this species has been referred to *Urostachys erikssonii* Nessel (type from Colombia), and *U. orionis* Herter (type from Venezuela) (Herter, 1958). The taxonomic identity of the types of these names is not well understood at present, but they do not correspond to any material I have seen from Central America.

Huperzia talamancana is apparently related to *H. crassa*, with which it often coexists in Costa Rica, and with which it has often been confused. *Huperzia crassa* (Fig. 3) differs from *H. talamancana* by the heteroblastic shoots (Fig. 3a), by the smaller and usually closely imbricate, somewhat pruinose leaves, (4–)5–8 × 1–1.5(–1.8) mm (Fig. 3b). The abaxial leaf epidermis is usually rugose due to protruding, blisterlike cells, while the margins have few or no specialized, protruding cells. In contrast, *H. talamancana* has homoblastic shoots (Fig. 2a), and leaves (6–)8–11 × (1.5–)2–3 mm, ascending to loosely imbricate (Fig. 2b, c), abaxially smooth and often shining, not pruinous, or sometimes with few protruding, blisterlike epidermal cells, while the margin

cells are specialized and usually individually protruding. It is a variable species, especially with regard to the direction of the leaves, responding strongly to the light conditions of the habitats, as shown by the specimens in Figure 2b, from a light-exposed habitat, and Figure 2c, from a somewhat shaded habitat.

Paratypes. COSTA RICA. SAN JOSE: Cerro de las Vueltas, 2,700–3,000 m, 1 Jan. 1926, *Standley & Valerio 43611* (US), *44004* (US), *44006* (F, US); Road Cartago–S. Isidro del General, km 88.5, Asunción, 3,335 m, 29 Jan. 1986, *A. Smith 2008* (MO, UC); Cerro de la Muerte, páramo de Buenavista, 1–3 km S of Interamerican Highway, 3,350 m, 9 Aug. 1967, *Lellinger 869* (US), *870* (MO, US); Cerro de la Muerte, N slopes, 11,000 ft., 25 May 1971, *Proctor 32070* (MO), 3,300–3,400 m, *Alverson 1853* (MO); Cerro Asunción, near Cerro de la Muerte, 3,335 m, 4 Aug. 1965, *Croat 507*, *509* (MO), *Stone 2035* (UC); Cerro de la Muerte, 25 July 1983, *Hickey & Regan 890* (AAU); Asunción summit, 3,335 m, 22 July 1966, *Davidse & Pohl 10118* (MO); Hotel La Georgina–Cerro Frío, Cerro de la Muerte, 3,100–3,400 m, 9°33′N, 83°43–46′W, *Davidse et al. 25008* (AAU, UC); Cerro de la Muerte, km 91 of Pan American Highway in Cordillera de Talamanca, 3,300 m, *Whitmore 41* (F, GH); Cerro de la Muerte, 3,200 m, *Burch 4731* (MO); Cerro de la Muerte, 3,200 m, *Lorence 1751* (MO), *1752* (MO); Cerro de la Muerte, 3,400 m, *Taylor 11730* (MO); Cerro de la Muerte, páramo Buena Vista, 1–3 km S of Interamerican Highway, 3,350 m, *Mickel 3249* (UC, US); páramo de Buenavista, 3,400 m, 14 June 1967, *de la Sota 5047* (US); Cerro de la Muerte, 3,300 m, 7 Aug. 1976, *Solomon 2532* (MO). SAN JOSE–CARTAGO: near Asunción, 9°34′N, 83°45′W, 3,300–3,400 m, *Burger & Stolze 5982* (F, MO), *5977* (F, GH), *5985* (F, MO); Interamerican Highway near La Asunción, 3,200–3,300 m, 9°34′N, 83°45′W, 21 Nov. 1969, *Burger & Liesner 6349* (F, GH, MO); Cerros Cuericí, 9°35′N, 83°38′W, 3,200 m, *Davidse 24762* (AAU); páramo at La Asunción, 3,335 m, *Mickel 2117* (US), *2118* (US), *2120* (NY). CARTAGO: Cerro de la Muerte, La Virgen de los Angeles páramo, 3,000 m, *Brown CR-88* (US); Talamanca range, near Pan American Highway, 3,400 m, 25 Feb. 1965, *Lent 392* (F); San Isidro del General–Cartago, 3,400 m, 11 Jan. 1964, *McKee 11203* (P, UC, US); Cordillera Talamanca, 3,300 m, 25 Aug. 1961, *C. Weber 6067* (US); Cerro de la Muerte, 3,000 m, 19 Feb. 1957, *M. Carlson 3512* (GH); Cerro de la Muerte, La Virgen de los Angeles páramo, 3,470 m, *Godfrey 66717* (GH); Cerro Sakina, páramo Buena Vista, 3,000 m, *Churchill 3367* (AAU); Cerro de la Muerte, páramo de Buena Vista, E side, 3,000 m, 24 Jan. 1981, *Churchill 3711* (AAU); Cerro Buenavista, 3,000–3,300 m, 12 May 1982, *Huft et al. 2141* (AAU); Cordillera Talamanca, Mt. Cerro de la Muerte, El Alto de Asunción, 3,335 m, 4 Mar. 1966, *Molina R. et al. 18338* (F, US); Cerro de la Muerte, 3,200 m, 17 May 1956, *L. O. Williams 20052* (US), 3,300 m, 30 Mar. 1949, *L. O. Williams 16087* (F, MO, US), 3,200 m, 9°35′N, 83°45′W, 1 Feb. 1965, *L. O. Williams et al. 28833* (F, GH, US); Cerro de la Muerte, 11,000 ft., 11 July 1961, *Brown C. A. CR-88* (US). LIMON: SW foot of Cerro Kámuk, 9°16′N, 83°02′W, 3,200–3,350 m, *Davidse et al. 25978* (MO). HEREDIA: Buenavista Massive, 10,900 ft., 33 mi. NW of San Isidro del General, 31 July 1964, *Woodruff s.n.* (US). PANAMA. CHIRIQUI: Volcán de Chiriquí, Loma Larga to summit, 2,500–3,380 m, 4–6 July 1938, *Woodson et al. 1079* (GH, MO, US). BOCAS DEL TORO: between Itamut and Bine peaks, Fabrega Massif, 3,200 m, 5–9 Mar. 1984, *Gómez et al. 22259* (AAU, UC).

Huperzia curvifolia (Kunze) Holub var. **parvifolia** (Nessel) B. Øllgaard, comb. nov. Basionym: *Urostachys verticillatus* (L. f.) Herter var. *parvifolius* Nessel, Revista Sudamer. Bot. 6: 163, f. 43. 1940. TYPE: Costa Rica. Volcán Barba, *Brade & Brade 283* (HB not seen, BONN-Herb. Nessel no. 247).

Lycopodium verticillatum L. f. var. *parvifolium* (Nessel) Lellinger, Proc. Biol. Soc. Wash. 89: 719. 1977.

The material treated under this name is variable and referred here tentatively. Most specimens are somewhat intermediate between *Huperzia acerosa* and *H. curvifolia* var. *curvifolia* (Andes). Some specimens approach slender forms of *H. filiformis*. In general, the distinction of species in this group is problematic. *Huperzia curvifolia* var. *curvifolia* is an extremely thin form, with almost capillary stems, strongly upward curved leaves in proximal divisions, and closely appressed and reduced nonsporangiate leaves in the narrow, distal divisions. Variety *parvifolia* has thicker stems and is larger, with slightly less closely appressed nonsporangiate leaves in distal divisions, but shares the upward curved leaves in proximal divisions with the type variety.

The epithet *parvifolia* is unfortunate in the present context because it does not describe the relation to the type variety, but it is the only legitimate choice.

Acknowledgments. I thank Kirsten Tind for preparation of Figure 1, and Anni Sloth for Figures 2 and 3.

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The Identification of *Hieracium kalmii* (Asteraceae)

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ABSTRACT. The types of *Hieracium kalmii* and *H. canadense* are taken to represent two extremes within a species complex. A new combination, *H. kalmii* var. *canadense*, is proposed.

Hieracium kalmii L. (Asteraceae) was established by Linnaeus (1753: 804) based on a Pehr Kalm collection (*954.43*, holotype, LINN) obtained in Pennsylvania. The unusual fruit prompted Monnier (1829: 81) to place the species in its own genus, *Sclerolepis*, which proved to be a later homonym of *Sclerolepis* Cassini, and was renamed *Pachylepis* by Lessing (1832: 139). Gray examined the Kalm sheet and suggested (Torrey & Gray, 1843: 479) that the plant was probably not native to North America. Gray (1884: 424) later concluded that *H. kalmii* was not a species of *Hieracium*. Zahn (1923: 1563), the last monographer of *Hieracium*, retained *H. kalmii* in *Pachylepis* without comment. Fernald (1943) could not satisfactorily dispose of *H. kalmii*, and while he felt it was similar to *H. canadense* Michaux (1803: 86), and especially the southern variety *fasciculatum* (Pursh) Fernald, he regarded the Kalm sheet as representing an introduced exotic. Since 1943, *H. kalmii* has been essentially excluded by American authors from regional floras except for Lepage (1960), who took up *H. kalmii* for *H. canadense* in part.

Lepage (1960) considered the species represented by the Kalm specimen to be a plant of southeastern Canada and New England, and to be most closely related to *H. canadense* and *H. scabriusculum* Schweinitz. His conclusion was not accepted by Gleason & Cronquist (1962) nor by Scoggan (1979), and the name has not been taken up by subsequent authors.

My own examination of the Kalm sheet initially suggested that the plant belonged to the genus *Crepis*, specifically nearest the European *C. vesicaria* L. subsp. *taraxacifolia* (Thuillier) Thellung. The short, plumpish achenes were unlike any I found in herbarium material of this now widespread and weedy subspecies found in Europe, Africa, and North America. Like Gray, I could not match the achenes with any species of *Hieracium*.

When the late Arthur Cronquist (NY) visited The Natural History Museum (BM) in August 1991, I outlined the problem and produced the Kalm sheet for his examination. He concluded that the specimen was indeed a member of *Hieracium*, and the achenes were merely immature. We concluded that the Kalm specimen represented what Cronquist (Gleason & Cronquist, 1991) was (in August 1991) about to name *H. kalmii*.

The variation within *Hieracium kalmii* is complex and no doubt subject to many interpretations. Lepage (1960) recognized both *H. canadense* and *H. kalmii* at the species rank, and recognized varieties in each. He associated the Kalm specimen with the smaller, less branched, more northern form of the species with an open capitulescence. The larger, more southern expression with an umbelliform capitulescence he named *H. kalmii* var. *fasciculatum* (Pursh) Lepage.

My evaluation of the Kalm sheet, like Fernald's (1943), is that it is a depauperate form of variety *fasciculatum*. Linnaeus stated that the Kalm specimen was found in Pennsylvania, and while one cannot discount the possibility that Kalm gathered it in John Bartram's garden near Philadelphia, it probably came from the southern part of the species' range.

As *Hieracium kalmii* (1753) has priority over *H. canadense* (1803), the following combination is proposed:

Hieracium kalmii L. var. **canadense** (Michaux) Reveal, comb. nov. Based on *H. canadense* Michaux, Fl. Boreali-Amer. 2: 86. 1803 var. *canadense* established by *H. canadense* var. *latifolium* Torrey & A. Gray, Fl. N. Amer. 2: 476. 1843.

The variety *kalmii* is the taller (5–15 dm) and more robust expression of the species with numerous (25–50) firm leaves that seldom have long hairs on the lower surface, and umbelliform capitulescences with short, stout peduncles 2–4 cm long. The variety ranges from Quebec to Minnesota south to New Jersey, Ohio, Illinois, and Missouri. The variety *canadense* is a shorter (1.5–10 dm) and more slender expression with few (5–30) thinner leaves typically

with long hairs on the lower surfaces, and more open capitulescences with longer and more lax peduncles 2–10 cm long. This variety occurs from Labrador and New England to Manitoba and Montana, and is disjunct from British Columbia to Oregon.

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New Species of *Ericentrodea* from Bolivia and Colombia (Asteraceae, Coreopsidinae, Heliantheae)

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ABSTRACT. *Ericentrodea davidsmithii* from Bolivia and *E. ramirezii* from Colombia are described. A key is provided for the six known species of the Andean genus *Ericentrodea*.

The genus *Ericentrodea* Blake & Sherff (Blake, 1923) was established for a group of Coreopsidinae in Ecuador and Colombia that had strongly obcompressed achenes with contracted apices, 6–15 pappus bristles mostly in two groups over the angles of the achenes, and a marginal wing bearing a dense fringe of spreading setulae. A species with more highly dissected leaves later described from northern Peru, *E. decomposita* Blake & Sherff (Sherff, 1931), was the southernmost known record for the genus for over 60 years. Now, material collected in 1989 by the late David Smith in Bolivia is described, representing a considerable southeastward extension of the known generic range. The Bolivian species is similar to the Peruvian species in its highly dissected leaves. The species is named here after the collector. A second new species is also described from the northern part of the generic range in Colombia. The Colombian species is coauthored by Santiago Diaz-Piedrahita of the Universidad Nacional de Colombia, who brought the material for study, and is named for the collector B. R. Ramírez P. of the Herbario Universidad de Nariño.

Ericentrodea davidsmithii H. Robinson, sp. nov.
TYPE: Bolivia. Santa Cruz: Provincia Manuel Maria Caballero, 50 km al norte de Mataral (por la carretera Santa Cruz–Comarapa) pasando por San Juan del Potrero y bajando a la cuenca del alto Río Ichilo, 2,000–2,100 m, 26 May 1989, *Smith, Quintana & García 13419* (holotype, US; isotype, MO). Figure 1A, D, E.

Ad *E. decompositam* simila sed in caulibus glabris in capitulis subsolitariis et majoribus in bracteis involucri interiores ad 9 mm longis et 3.5 mm latis in acheniis superne in collo prologatis et breviter bilobatis et in setis pappi majoribus utrinque ca. 8 differt.

Flexuous vines with internodes ca. 8–9 cm long, stems essentially terete, multistriated with 6 stronger striae, glabrous, narrowly fistulose. Leaves opposite, petioles 4.5–6.5 cm long, petioles and petiolules glabrous; blade (Fig. 1E) broadly triangular, mostly 10–15 cm long and wide, tri- to quadri-ternate, 30–40 ultimate pinnae deeply lobed to pinnatifid, generally ovate, 15–30 mm long, 12–17 mm wide, apices obtuse to shortly acute and minutely mucronate, surfaces glabrous with slightly prominulous veinlets. Inflorescence of ca. 3 heads on small lateral branches, holotype specimen with only 1 head fully developed at end of branch; peduncle ca. 3.5 cm long, glabrous. Head (Fig. 1A) homogamous, ca. 13 mm high, when mature with spreading bracts ca. 20 mm wide; outer involucral bracts herbaceous, linear, 7–8 mm long, ca. 1.5 mm wide; inner involucral bracts reddish yellow, oblong, 8–9 mm long, 2.5–3.5 mm wide, apex shortly acute, outer surface glabrous, with numerous longitudinal reddish lines; pales flat, similar to inner involucre in size, shape, texture, and lack of pubescence. Rays lacking. Florets 20–25, all bisexual; corolla yellow, ca. 8 mm long, tube ca. 2.5 mm long, glabrous, throat abruptly and narrowly campanulate, ca. 5 mm long, glabrous, lobes triangular, ca. 0.4 mm long and 0.3 mm wide, with scattered, narrow, monoseriate, multicellular hairs outside; anther thecae and appendages black, thecae ca. 3.5 mm long, appendages ovate, ca. 0.8 mm long, with median reddish duct reaching near tip; style branches flat, with narrow median groove and median reddish duct. Achenes (Fig. 1D) immature, strongly obcompressed, ca. 5.5 mm long, with narrow marginal wing, glabrous inside and outside, densely fringed by biseriate- and triseriate-celled setulae along margins, constricted above into a glabrous, broad neck ca. 1 mm long, apex shallowly but distinctly bilobed; pappus with 6–8 stout, retrorsely barbed bristles on each lobe, 1.5–2.0 mm long, with single smaller, smooth setulae at inner ends of each cluster. Pollen grains ca. 28 μm diam.

Ericentrodea davidsmithii is known only from the type. The habitat given for the collection is "bosque primario, bosque pluvial montano; laderas con abundante *Prumnopitys* y pastizales anthropogénicos."

The new species appears closest in relationship to the geographically closest *Ericentrodea decom-*

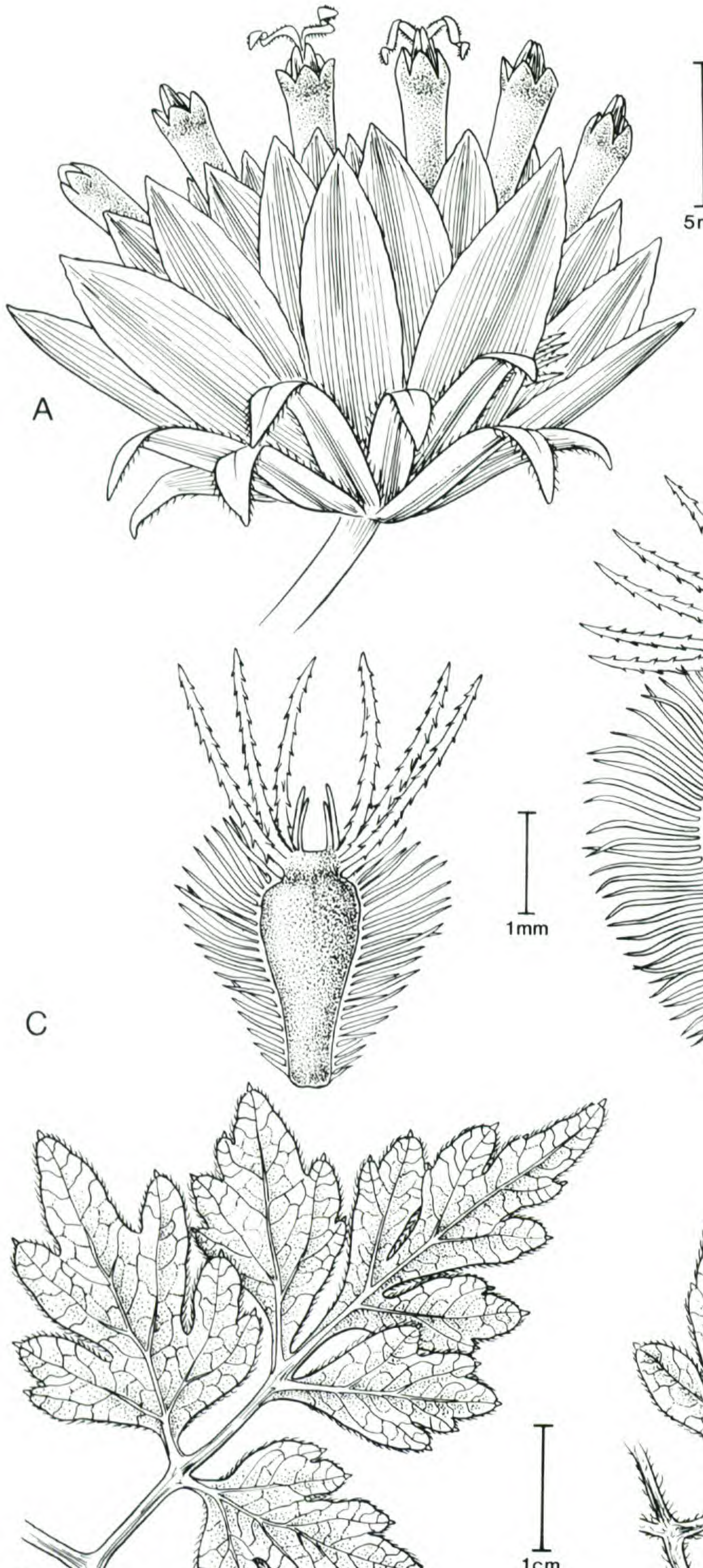

Figure 1. *Ericentrodea*. A, D, E. *E. davidsmithii* H. Robinson. B, C, F. *E. decomposita* Blake & Sherff. —A, B. Heads. —C, D. Achenes. —E, F. Portions of leaves.

posita of northern Peru. The latter is the only other member of the genus with as highly dissected, tri- to quadri-ternate leaf blades, having 20–40 leaflets. The four northern species in Ecuador and Colombia also have divided leaves, but the blades are only ternate or biternate. The most dissected leaves of *E. mirabilis* (Sherff) Blake & Sherff and the following new species, *E. ramirezii*, have 15–20 leaflets at most. *Ericentrodea davidsmithii* differs from *E. decomposita* by its glabrous stems, petioles, petiolules, and peduncles, more ovate leaflets, nearly solitary and much larger heads with broader and larger inner involucral bracts, achenes with a prominent neck, slight apical sinus, and its ca. 8 retrorsely barbed bristles in each of the two clusters. In contrast, *E. decomposita* has puberulous stems, petioles, and peduncles, rather elliptical leaflets, more numerous and smaller heads 7–8 mm high, achenes without a glabrous neck or bilobed tip, only 3 or 4 retrorsely barbed bristles in each of the clusters, and with ca. 2 smaller setulae on the inner ends of the clusters. Each species is known from a single collection, and achenes of both are somewhat immature, but the degree of immaturity seems nearly the same, and the differences in achene apices are regarded as reliable species differences. On the basis of the limited material, the stem of the new species also seems more terete. The stems of the holotype (F) and isotype (US) of *E. decomposita* examined are strongly hexagonal.

Illustrations are provided for a head, an achene, and a portion of a leaf for the new species and for the previously unillustrated *E. decomposita*.

Ericentrodea ramirezii H. Robinson & S. Diaz-Piedrahita, sp. nov. TYPE: Colombia. Nariño: Mpio. de Pasto, 2–3 km E de la población de Dolores, 2,900–3,000 m, 8 Feb. 1992, *B. R. Ramírez P. & J. A. Cuayal M 4584* (holotype, COL; isotype, US).

In foliis biternatis in foliolis 15–20 apice rotundatis vel breviter obtusis in capitulis homogamis et in setis pappi erectis solum in fasciculis binis dispositis a congeneribus differt.

Vines with internodes 3.5–5.0 cm long, stems weakly hexagonal, sparsely puberulous, not fistulose. Leaves opposite, petioles 2.5–3.0 cm long, petioles and petiolules sparsely puberulous; blade broadly triangular, up to 8 cm long, 8–10 cm wide, biternate or with basal triternate lobules, ca. 20 broadly ovate leaflets mostly 15–25 mm long, 9–17 mm wide, apices rounded to shortly obtuse, margins crenate-serrate, upper surface minutely puberulous on veins, lower surface sparsely pilosulous, secondary veins pinnate, ascending, slightly prominulous. Inflorescences on short lateral branches bearing reduced bi-tri-foliolate leaves, pyramidally thyrsoid; peduncles 7–15 mm long, glabrous. Heads homogamous, ca. 8 mm high, submature 7–8 mm wide; outer involucral bracts herbaceous, narrowly oblong, 2.5–4.0 mm long, ca. 0.8 mm wide; inner involucral bracts reddish yellow, oblong, ca. 6 mm long, 1.5–2.0 mm wide, apex shortly acute, outer surface glabrous, with numerous longitudinal reddish lines; pales flat, similar to inner involucre in size, shape, texture, and lack of pubescence. Rays lacking. Florets 20–25, all bisexual; corolla yellow, submature, ca. 5 mm long, mostly glabrous, basal tube ca. 1 mm long, throat narrowly campanulate, ca. 3 mm long, lobes triangular, 1 mm long, ca. 0.5 mm wide, pilosulous with a few monoseriate multicellular hairs outside; anther thecae and appendages black, thecae ca. 2 mm long, appendages ovate, ca. 0.5 mm long; style branches flat, with depressed median groove inside, shortly apiculate. Achenes strongly obcompressed, immature, ca. 1 mm long, glabrous inside and outside, densely fringed by setulae along margins, not obviously constricted above; pappus of two widely separated clusters of 4–5 retrorsely barbed bristles, 1.5–2.5 mm long, each group on short raised lip of apical callus. Pollen grains ca. 30 μm diam.

Ericentrodea ramirezii is known only from the type. Detailed habitat data is lacking, but the cited elevation of 2,900–3,000 m is common for the genus in the northern Andes. The area around Pasto is associated with the eastern Cordillera in Nariño.

Ericentrodea ramirezii is closest to *E. homogama* and *E. mirabilis*, but it differs from both by the rounded or shortly obtuse tips on the leaflets. The species differs further from *E. mirabilis* by the lack of extra pappus bristles between the two primary clusters. The achenes are too immature to see whether a lateral wing will develop or whether the pappus will ultimately be raised on a prominent lobe and be directed laterally as in *E. homogama*. In spite of the lack of certainty about the achene, the new species can be distinguished from *E. homogama* vegetatively by having leaves with ca. 20 blunt-tipped leaflets rather than having less dissected leaves with about nine pointed leaflets in three sets of three.

The six known species of *Ericentrodea* can be distinguished by the following key:

KEY TO THE SPECIES OF *ERICENTRODEA*

1a. Leaf blades tri- to quadri-ternate, highly dissected into 20–40 leaflets; species of Peru and Bolivia.

2a. Stems hexagonal; stems, petioles, and peduncles puberulous; inflorescences with 5–10 heads; heads 7–8 mm high; inner involucral bracts and pales 5–6 mm long and to 2 mm wide; achenes constricted but without a short glabrous neck above, not apically bilobed; pappus with 3–4 retrorsely barbed bristles in each cluster; northern Peru ..... *E. decomposita* Blake & Sherff

2b. Stems terete; stems, petioles, and peduncles glabrous; inflorescences with 1–3 heads, often only 1 developed; heads 12–14 mm high; inner involucral bracts and pales to 9 mm long and 3.5 mm wide; achenes with a distinct glabrous neck at upper end, slightly bilobed apically; pappus with 6–8 retrorsely barbed bristles in each cluster; central Bolivia ..... *E. davidsmithii* H. Robinson

1b. Leaf blades undivided to ternate or biternate, rarely with more than 12 leaflets; species of Colombia and Ecuador.

3a. Heads with rays; in fruit ca. 9 mm high and to 17 mm wide; upper leaves often simple; Colombia and Ecuador ..... *E. corazonensis* (Hieronymus) Blake & Sherff

3b. Heads without rays, homogamous; in fruit 6–8 mm high and 10 mm wide; upper leaves rarely simple.

4a. Achenes with pappus erect, often with 2–3 shorter bristles on each side between the main clusters; heads with ca. 12 florets; peduncles ca. 1 cm long; Ecuador ..... *E. mirabilis* (Sherff) Blake & Sherff

4b. Achenes with pappus separated at apex into two distinct, often laterally spreading clusters; heads with 20 or more florets; peduncles up to 3 or more cm long.

5a. Leaves biternate with usually nine leaflets; leaflets with apices acute; Ecuador ..... *E. homogama* (Hieronymus) Blake & Sherff

5b. Leaves biternate with 15–20 leaflets; leaflets with apices rounded or shortly obtuse; Colombia ..... *E. ramirezii* H. Robinson & Diaz-Piedrahita

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Reappraisal of Subtribe Vargasiellinae (Maxillarieae, Orchidaceae)

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ABSTRACT. Subtribe Vargasiellinae, proposed by C. Schweinfurth in 1952, is here validated. It is placed in tribe Maxillarieae, rather than in the Malaxideae, as originally proposed by Schweinfurth, based on new findings on the pollinarium structure of *Vargasiella peruviana* C. Schweinfurth.

Schweinfurth described *Vargasiella* in 1952 from two Peruvian specimens collected by C. Vargas. The morphology of the inflorescence and pollinarium puzzled the author; the absence of complete pollinaria in the specimens he examined led him to believe *Vargasiella* was close to subtribe Liparideae (in Schlechter's old system, referred to tribe Malaxideae Lindley in Dressler, 1990: 217). However, based on leaf and flower characters, Schweinfurth (1952: 152) suggested subtribal status for *Vargasiella*, but failed to validly publish the taxon.

Schweinfurth (1958: 219) described a second species from the Venezuelan Guayana; the flowers he had available did not have complete pollinaria. *Vargasiella venezuelana* was collected a second time by G. C. K. Dunsterville (Dunsterville & Garay, 1965: 326; Dunsterville & Dunsterville, 1982: 37), but this material and his subsequently published drawing (Dunsterville & Garay, 1965: 326–327; 1979: 1037) did not present critical details of the pollinarium.

Dressler (1990: 249) suggested the placement of *Vargasiella* in subtribe Zygopetalinae: "The Andean *Vargasiella* has been described as having naked pollinia, but the pollinia appear to be superposed, and I suspect that it is closer to this group" (i.e., subtribe Zygopetalinae). However, examination of recently collected specimens of *Vargasiella peruviana* indicate the pollinarium has four plano-convex pollinia, a short stipe, and a hooked viscidium (Fig. 1). The pollinia do not appear to be superposed and flattened as in *Zygopetalum* and other allied genera. These features, combined with the fact that the labellum does not have any ridges or keels, a diagnostic feature of subtribe Zygopetalinae, indicate that *Vargasiella*, although closely allied to the Zygopetalinae, merits subtribal status.

Vargasiellinae C. Schweinfurth ex G. Romero & Carnevali, subtrib. nov. TYPE: *Vargasiella* C. Schweinfurth, Bot. Mus. Leafl. 15: 150. 1952.

Herba epiphytica vel terrestris; caulis elongatus, sine pseudobulbis; folia disticha, plicata, articulata; inflorescentia laxe racemosa; labellum simplex, ecallosum; pollinarium viscidio unico, stipite unico, polliniis quatro, plano-convexis, non-superimpositis.

The authors would like to request live and/or pickled specimens of *Vargasiella* from orchid collectors and growers from Peru and Venezuela. This material is urgently needed to undertake further studies, particularly of cytology, growth habits, and the development of the inflorescence. We hope the examination of additional specimens will shed some light on the placement of this interesting genus within the Maxillarieae.

Specimens examined. Vargasiella peruviana C. Schweinfurth. PERU. CUZCO: Prov. Paucartambo, Pillahuata, 3,400 m, epiphyte in rainforest, floral segments white lined with pink, 11 Dec. 1942, *C. Vargas 3010* (AMES); Convención Prov., hills of Pintobamba, in humus forest, 2,400 m, perianth white with pinkish lip, 3–4 Mar. 1943, *C. Vargas 3288* (holotype, AMES). PASCO: Oxapampa Prov., Cordillera Yanachaga, road over shoulder of Cerro Pajonal to Villa Rica drainage, 12 km SE of Oxapampa, cloud forest, 2,300–2,500 m, 10°35′S, 75°20′W, "Terrestrial 1 m; stem zig-zag; petioles grooved; bracts green with purple rim; two lower sepals purple outside, whitish inside; upper sepal white with purplish stripe down middle; petals white, lip and undulate margin maroon tongue; stem purple," 9 Oct. 1982, *R. B. Foster & D. Smith 9094* (MO); same locality, 14 km E of main Oxapampa–Villa Rica road, lumber road at top of cordillera; stunted cloud forest, 2,450 m, 10°35′S, 75°15′W, terrestrial, flower white, maroon outside and on lip, 2 Mar. 1982, *A. Gentry & D. Smith 35984* (MO); border Provincias Oxapampa and Pasco, San Cotardo, in dwarf forest, rich in Ericaceae, bamboo and *Blechnum*, with sphagnum layer below, in swampy places, 2,700 m, terrestrial, flowers white with red, 7 Mar. 1986, *H. van der Werff et al. 8508* (MO).

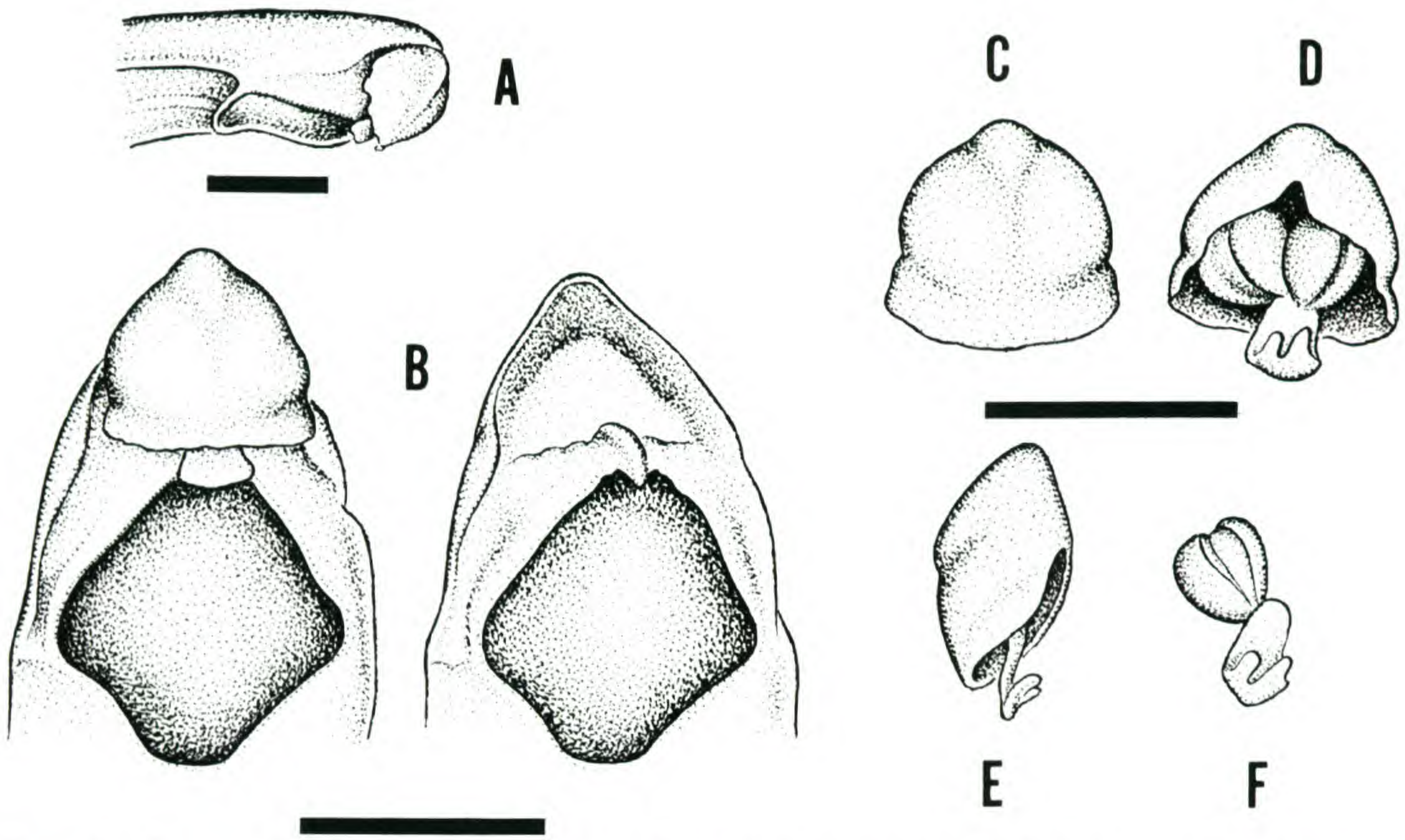

Figure 1. *Vargasiella peruviana* C. Schweinfurth (*Foster & Smith 9094*). —A, B. Column. —C–E. Anther. —F. Pollinarium. (Scale bars equal 2 mm.)

Vargasiella venezuelana C. Schweinfurth. VENEZUELA. BOLIVAR: Chimantá Massif, NW part of summit of Abácapa-tepui, *Bonnetia* forest, 2,125–2,300 m, terrestrial, inflorescence erect, all parts of flower rich purple, 3 sepals projecting backwards, 2 lateral petals erect, bracts green, peduncle dull lavender, leaves firmly membranous, deep green above, dull green below, 13 Apr. 1953, *J. A. Steyermark 74914* (holotype, AMES; isotype, AMES); Auyán-tepui, above El Peñon, growing almost completely hidden in low thick brush and grass on steep slope, elevation ca. 6,500 ft., *G. C. K. & E. Dunsterville 861* (line drawing, AMES).

Acknowledgments. We thank Cirilo Nelson for comments on the Latin description and Bruno Manara for the line drawings.

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New Species of *Hedyosmum* (Chloranthaceae) from Northern South America

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ABSTRACT. Four new species of *Hedyosmum*, all belonging to subgenus *Tafalla* sect. *Microcarpa*, are herein proposed. *Hedyosmum uniflorum* occurs in mid-elevation montane regions in central Ecuador and differs from its closest relative, *H. bonplandianum*, by its basally rounded, sometimes oblique leaves, flocculose midveins, slightly fimbriate stipular appendages, and long, linear, dissected stigmas. *Hedyosmum narinoense*, which inhabits the western slopes of the western cordillera in southern Colombia, also has single-flowered cymules but is unique among the solitary-flowered cymule species by having shorter pistillate inflorescences and scabrous, scurfy leaf sheaths. The remaining two new species, *H. tepuiense* and *H. intermedium*, are found in the Venezuelan Guayana. *Hedyosmum tepuiense* is recognized as distinct from the broadly ranging *H. racemosum* by virtue of its long stipular appendages, verrucose leaf sheaths, floccose midveins, and longer inflorescences. Morphologically intermediate between *H. gentryi* and *H. neblinae*, *Hedyosmum intermedium* is distinguished by its glabrous, elliptic leaves and 2–3-flowered purple-fruited cymules.

Recent collections from South America have clarified the status of several populations of *Hedyosmum* that were previously incorporated into the variation of broadly ranging species (Todzia, 1988). All of these newly described species fall into subgenus *Tafalla* sect. *Microcarpa*, the largest section in *Hedyosmum*, now with 28 species. This section is recognized by racemose or paniculate pistillate inflorescences, cymules of 1–8 flowers, fleshy floral bracts that are fused in fruit, and white, rarely purple, fruiting cymules.

Hedyosmum uniflorum Todzia, sp. nov. TYPE: Ecuador. Pichincha: old road Quito–Santo Domingo, 12–15 km NE of old road from junction with new road near Alluriquin, 1,430–1,540 m, ca. 0°20′S, 78°55′W, 3 Feb. 1982, *Luteyn, Pipoly, Lebrón-Luteyn & Kallunki 8754* (holotype, TEX; isotypes, NY, QCA not seen). Figure 1.

Hedyosmo bonplandiano foliis laevibus et cymulis flore singulo instructis similis sed differt appendicibus fimbriatis stipularum, foliis ad basim rotundatis aliquando obliquisque trichomatibus floccosis in nervi centrali paginis inferis, et stigmatibus longis linearibusque.

Dioecious (?), aromatic trees or shrubs 4–8 m tall; young stems quadrate; older stems terete, with tubular leaf bases persisting, ultimately disintegrating and leaving circular scars; internodes 3–8 cm long. Leaves elliptic, 7.5–15.5 cm long, 3–6.5 cm broad, with long-acuminate tips 0.5–1 cm long, rounded, often oblique at base, at margins sharply serrate with teeth 3–4 mm distant, drying subcoriaceous, smooth to slightly scabrous; midveins impressed above, raised beneath, with sparse floccose multibranched trichomes; larger lateral veins 6–9, 0.6–1.8 cm distant, arcuate, raised beneath, glabrous or occasionally with sparse strigose to flocculose hairs; free portion of petioles 0.6–1.4 cm long, glabrous except for occasional flocculose hairs running down midrib onto petiole; petiolar sheaths 1.3–1.8 cm long, 0.5–1 cm broad at apex, inflated, slightly flared at apex, with two strigose lines extending down from the free portion of petioles, persistent but disintegrating with age, each distal margin with two slightly fimbriate, stipular appendages 1–2 mm long, extending above free portion of petioles ca. 0.5 mm. Staminate inflorescences not seen. Pistillate inflorescences axillary or terminal, racemes or sparsely branched panicles, 3.5–8 cm long with 16–46 cymules; subtending bracts similar in size and shape to the leaves or more frequently smaller; cymules 1(–3)-flowered, alternately or oppositely arranged on the rachis, 3–10 mm distant, sessile or on short peduncles 1–3 mm long; subtending floral bracts enclosing one-fourth to three-quarters of flower, with acuminate tips 0.5–1 mm long, margin entire or with occasional strigose hairs. Pistillate flowers slightly trigonous, ca. 3 mm long, ca. 2 mm broad, with or without a small pore on each face of the ovary; perianth lobes small, deltoid; stigmas usually highly dissected, linear, 2–3 mm long, papillose. Fruiting cymules green (?).

Distribution, habitat, and phenology. Known

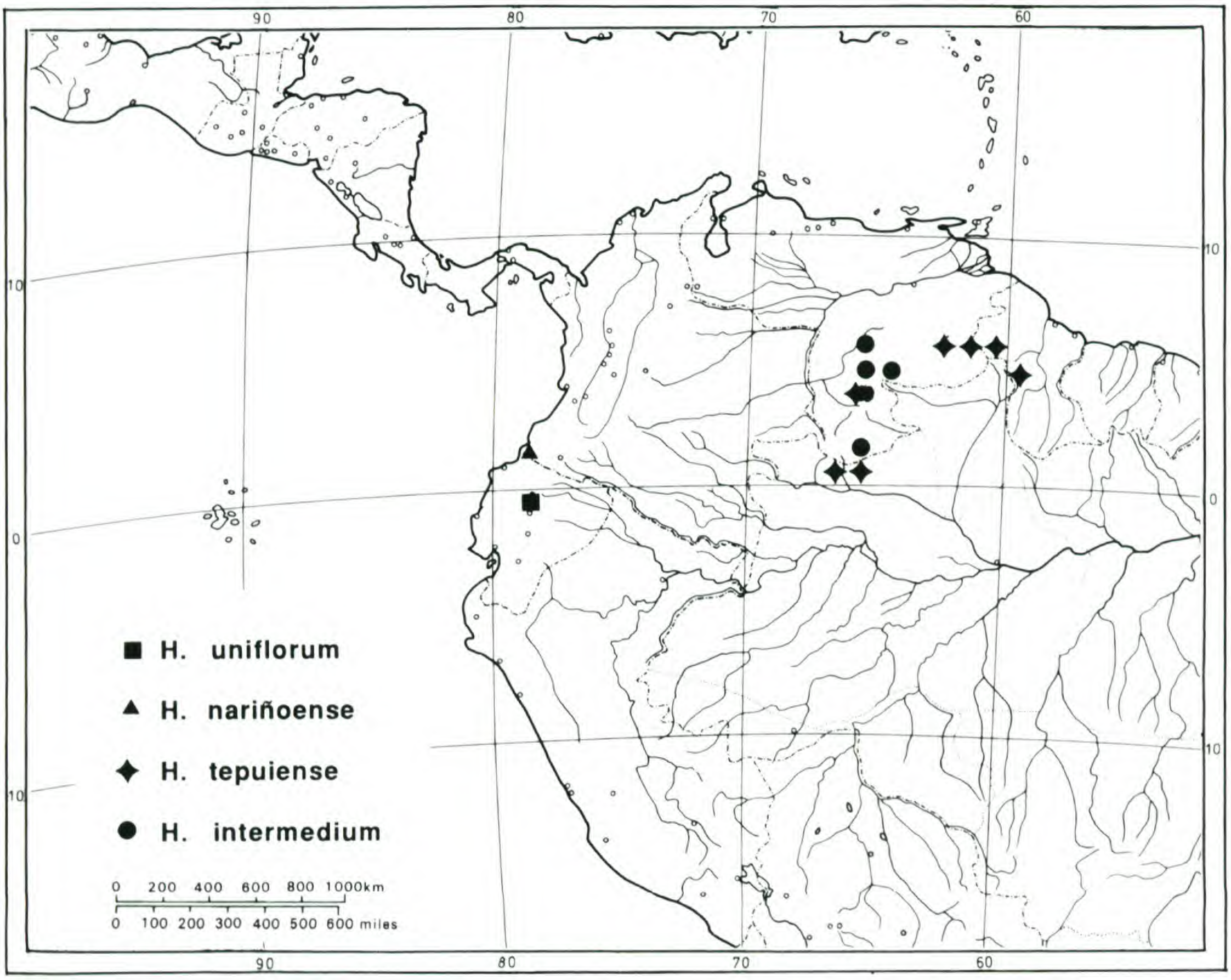

Figure 1. Distribution of the new species of *Hedyosmum*. Each symbol represents the presence of that respective species in a degree square.

only from central Ecuador (Prov. Pichincha) on the western slopes of the western cordillera, where it occurs between 1,300 and 2,200 m in disturbed cloud forest and montane wet forest. Flowering specimens have been collected in February, July, September, and December.

Hedyosmum uniflorum appears to be most closely allied to *H. bonplandianum* and *H. racemosum*. This new species is similar to *H. bonplandianum* in having usually single-flowered cymules and leaves smooth upon drying. It differs from *H. bonplandianum* in having long, linear stigmas (vs. stigmas shorter and more clavate), leaves rounded and sometimes oblique at base (vs. attenuate), flocculose hairs on midvein beneath (vs. entirely glabrous), and stipular appendages slightly fimbriate (vs. usually linear). If its fruiting cymules are green at maturity as indicated by label data, this would also be a character at variance with *H. bonplandianum*. Fruiting cymules of all previously known species of subgenus *Tafalla* sect. *Microcarpa* are either white or purple. The southernmost populations of *H. bonplandianum* occur in southern Colombia (Depto. Cauca).

Although this population was originally placed into *H. racemosum*, it was noted that its solitary-flowered cymules and long (up to 3 mm), highly dissected stigmas were anomalous within the *H. racemosum* species concept (Todzia, 1988: 75). Morphological characters shared with *H. racemosum* include slightly fimbriate stipular appendages and leaves smooth upon drying. As noted above, *H. uniflorum* differs from *H. racemosum* in having usually single-flowered cymules, highly dissected stigmas, as well as rounded often oblique leaf bases (vs. attenuate and not oblique) and fruiting cymules green not white.

Paratypes. ECUADOR. PICHINCHA: Carretera Quito–Aloag–Santo Domingo de los Colorados, km 94, a 10 km al S de la carretera, estribaciones occidentales del Volcán Corazón, 0°21′30″S, 78°51′15″W, 1,300–1,500 m, 24 Dec. 1986, *Zak 1492* (MO, TEX); Reserva Florística-Ecológica "Rio Gualjalito," km 59 de la carretera antigua Quito–Santo Domingo de los Colorados, estribaciones occidentales del Volcán Pichincha, 78°48′10″W, 0°13′53″S, 1,800–2,200 m, 9 July 1985, *Jaramillo & Zak 7735* (MO, TEX); Reserva Florística-Ecológica "Río Gualjalito," km 59, carretera antigua Quito–Santo Domingo,

faldas al oeste del Volcán Pichincha, 0°13′S, 78°48′W, 1,800–2,200 m, 24 Sep. 1988, *Zak & Jaramillo 3827* (TEX).

Hedyosmum narinoense Todzia, sp. nov. TYPE: Colombia. Nariño: 2–8 km E of Junín on Tumaco–Túquerres road, 1°15′N, 78°09′W, ca. 1,100 m, 26 July 1986, *Gentry et al. 55235* (holotype, MO; isotype, TEX—2 sheets). Figure 1.

Hedyosmo bonplandiano ac *H. uniflori* cymulis flore singulo instructis similis sed ab utroque differt inflorescentiis pistillatis brevioribus et vaginis foliorum furfuraceis scabris aetate provectis laciniatisque.

Dioecious (?) trees ca. 8 m tall; young stems quadrate, scurfy; older stems terete, becoming glabrous, with tubular leaf sheaths persisting and ultimately leaving circular scars; internodes 2.5–6 cm long. Leaves narrowly elliptic to elliptic, 8.5–12 cm long, 2.5–5 cm broad, with acuminate tips 0.5–1 cm long, rounded to attenuate at base, at margins sharply serrate with teeth 2.5–5 mm distant, drying coriaceous, smooth above, scabrous beneath; midveins impressed above, raised beneath, with sparse, floccose, multibranched trichomes; larger lateral veins 6–7, 11–20 mm distant, arcuate, raised and glabrous beneath; free portion of petioles 0.8–1.1 cm long, scabrous, rough; petiolar sheaths 1.6–2 cm long, 0.7–1.3 cm broad at apex, slightly inflated to somewhat closely appressed to stem, scurfy, becoming laciniate at upper margin with age, with slightly raised longitudinal lines extending down from distal margin, stipular appendages absent or early caducous. Staminate inflorescences not seen. Pistillate inflorescences axillary or terminal, racemes or sparsely branched panicles, 2.5–5.8 cm long with ca. 50 flowers, alternately arranged 1–8 mm distant on the rachis, subsessile or on short pedicles 1–3 mm long; lower inflorescence bracts similar to leaves but much smaller. Flowers usually solitary on rachis, rarely aggregated into clusters of 2, subtended by a fleshy cupular bract, on one side with an acuminate free tip ca. 1 mm long, enclosing lower half of flower. Pistillate flowers slightly trigonous, ca. 2 mm long, ca. 1 mm broad; perianth lobes united at base; stigmas clavate, dissected distally, ca. 2 mm long. Fruits white, ellipsoidal, 3–4 mm long, ca. 3 mm broad.

Distribution, habitat, and phenology. Known only from southern Colombia (Prov. Nariño) on the western slopes of the western cordillera where it occurs in pluvial forests and disturbed roadsides along cloud forest at elevations between 900 and 1,000 m. The three known collections were collected in flower and fruit in July.

Hedyosmum narinoense appears to share distinctive characters with several other species of *Hedyosmum*. It has the solitary flowers of *H. bonplandianum*, which ranges from Nicaragua to Colombia, and *H. uniflorum* of central Ecuador, yet differs from both by its shorter pistillate inflorescences, and scabrous and scurfy leaf sheaths that become laciniate with age. These laciniate leaf sheaths, along with its scabrous leaves, show a possible relationship to *H. scaberrimum*, which also occurs in southern Colombia. It differs from the latter species by its flowers, which are solitary on the inflorescence rachis (vs. in cymules of 2–4 flowers). Thus it is on the following suite of characters that the above collections are described as new: flowers borne singly on the inflorescence axis, not clustered into cymules; scabrous leaves with sparsely dentate teeth 2.5–5 mm distant; and scurfy, scabrous leaf sheaths becoming laciniate along the distal margin.

Paratypes. COLOMBIA. NARIÑO: Junín–Barbacoas road, 2–10 km N of Junín, 1°30′N, 78°10′W, 900–1,000 m, 26 July 1986, *Gentry et al. 55329* (MO, TEX).

Hedyosmum tepuiense Todzia, sp. nov. TYPE: Venezuela. Amazonas: Depto. Río Negro, Cerro de la Neblina, Expedition Camp VII, 0°50′N, 65°58′W, 1,850 m, 29 Nov. 1984, *Anderson 13389* (holotype, TEX; isotypes, MICH not seen, NY not seen, VEN not seen). Figure 1.

Hedyosmo racemoso inflorescentibus racemosis paniculatisque cymulis floribus aliquot instructis similis sed differt appendicibus stipularum maxime longis et vaginis foliorum verrucosis.

Dioecious, aromatic trees or shrubs 4–10 m tall; young stems quadrate; older stems terete with tubular leaf bases persisting, ultimately disintegrating and leaving circular scars; internodes 3–6 cm long. Leaves elliptic, 7.5–19 cm long, 2.3–10 cm broad, with long-acuminate tips 0.5–1.5 cm long, attenuate at base, at margins coarsely serrate with teeth 3–6 mm distant, drying subcoriaceous, scabrous; midveins impressed above, raised beneath, with floccose or strigose hairs; free portion of petioles 0.7–2 cm long, glabrous; petiolar sheaths 1.5–2.5 cm long, 1–1.4 cm broad at the apex, inflated, slightly flared at apex, smooth to verrucose especially along distal margin, extending above free portion of petioles ca. 0.5 mm, persistent but disintegrating with age, each distal margin with two linear to slightly fimbriate stipular appendages ca. 3 mm long. Staminate inflorescences composed of a straight rachis 2.5–6.5 cm long, with 2–3 nodes; nodes usually alternate, sometimes opposite, with 1 spike per node; spikes

sessile or on short peduncles 1–4 mm long; mature spikes 0.6–1.5 cm long, ca. 4 mm broad; stamens 50–100; anthers 1–1.5 mm long, connectives extended into a pad ca. 0.5 mm long with an apicule at summit. Pistillate inflorescences axillary or terminal, racemes or sparsely branched panicles, 3–10 cm long with ca. 20 cymules; cymules sessile or on short peduncles 1–5 mm long, oppositely or alternately arranged on rachis, 0.2–1.4 cm distant, very irregularly globose, 4–6 mm diam., subtending floral bracts connate in lower one- to two-thirds, enclosing one- to three-fourths of flower, the margin usually entire, occasionally with a few sparse strigose hairs. Pistillate flowers slightly trigonous, 2–3 mm long, 1–2 mm broad, with a small pore on each face of the ovary; perianth lobes small, ca. 0.3 mm long, rounded at apex; stigmas irregularly clavate, 1–2 mm long, 3-angled, papillose. Fruiting cymules white, irregularly globose, 4–9 mm diam. Seeds ca. 3 mm long, ellipsoidal, brown, smooth.

Distribution, habitat, and phenology. Occurs throughout a large region of the Venezuelan Guayana at elevations of 1,200–2,660 m in wet forest and riparian habitats. Flowering specimens have been collected in February, April, and November and fruiting specimens in March, October, November, and December.

The sandstone plateaus or tepuis of the Venezuelan Guayana are not a region of great *Hedyosmum* diversity as they are for some other groups of plants (Steyermark, 1979). Three species were previously reported from that area: *H. racemosum* (Ruiz & Pavón) G. Don, *H. gentryi* D'Arcy & Liesner, and *H. neblinae* Todzia (Todzia, 1988). This new species, *H. tepuiense*, was previously treated as *H. racemosum* in Todzia (1988). Another new species described below, *H. intermedium*, was previously treated as the southernmost populations of *H. gentryi*. Considering these taxonomic reevaluations, the three species found in the Venzuelan Guayana are now called *H. tepuiense*, *H. intermedium*, and *H. neblinae*.

Hedyosmum tepuiense is obviously closely allied to *Hedyosmum racemosum*, with both having racemose and paniculate inflorescences with several-flowered cymules. This new species differs from *H. racemosum* by its extremely long stipular appendages (4 mm long vs. 1–2 mm long for *H. racemosum*) and verrucose leaf sheaths (vs. glabrous in *H. racemosum*). *Hedyosmum tepuiense* has consistently larger leaves than populations of *H. racemosum* in the Andes, as well as floccose trichomes on the lower side of the midvein and longer inflorescences.

Paratypes. GUYANA. Upper Potaro River region, upper slopes of Mt. Wokomung, 05°05′N, 59°50′W, ca. 1,500 m, 4 July 1989, *Boom & Samuels 9063* (NY, TEX), 1,530 m, 13 July 1989, *Boom & Samuels 9200* (NY, TEX). VENEZUELA. AMAZONAS: Depto. Río Negro, Cerro de la Neblina, Expedition Camp VII, 00°50′N, 65°58′W, 1,850 m, 29 Nov. 1984, *Anderson 13410* (TEX), 1 Dec. 1984, *Anderson 13440* (TEX); Cerro Neblina, camp #7, S slopes of Cañon Grande, 1,800 m, along river below camp, 0°55′N, 66°0′W, 29 Nov. 1984, *Croat 59449* (MO, TEX), *Croat 59463* (MO, TEX); trail S from Cerro Neblina Camp #5, 1,200–1,300 m, 0°49′N, 66°0′W, 12 Apr. 1984, *Gentry & Stein 46570* (TEX); Depto. Río Negro, E of and below Neblina Camp 7, 0°55′N, 66°0′W, S slopes Canyon Grande, ca. 1,700 m, 29 Nov. 1984, *Kral 71905* (TEX); Depto. Atabapo, Cerro Marahuaca, summit SW side of center, sides and bottom of 120 m deep sinkhole, 3°39′N, 65°26′W, 2,600 m, 22 Oct. 1988, *Liesner et al. 25171* (TEX); Depto. Río Negro, Cerro de La Neblina, ridge at divide between Brazil and Venezuela, 26 km ENE of Neblina Base Camp, approx. 0°53′N, 65°56′W, 2,000 m, 15 Apr. 1984, *Plowman & Thomas 13629* (NY, TEX); Depto. Río Negro, Camp 7, 00°52′N, 65°58′W, 1,730–1,850 m, 1 Feb. 1985, *Renner 2058* (US). BOLIVAR: Cerro Apacará, Río Caroní, 1,850 m, 11 Nov. 1946, *Cardona 1956* (NY, US); Cerro Roraima, ca. 5°12′N, 60°40′W, 2,280–2,600 m, *Luteyn & Aymard 9769* (TEX); Ilú-tepui, Gran Sabana, 7–8,000 ft., 17 Mar. 1952, *Maguire 33470* (TEX); Mount Roraima, SW slopes, 2,400 m, 10 Jan. 1939, *Pinkus 130* (BR, F, G, GH, MO, NY, S, US); Cerro Uananapán, S of Uei-tepui, between Luepa and Cerro Venamo, 1,450 m, 25 Apr. 1960, *Steyermark & Nilsson 746* (NY, VEN); Chimantá Massif, SW edge of Apácara-tepui, 1,800–2,000 m, 14 Apr. 1953, *Steyermark 74972* (F, NY); Auyán-tepui, entre la escarpa superior, este del paso de acceso a la cumbre del sur y "El Peñón," 1,800 m, 17 May 1964, *Steyermark 94083* (NY,VEN); Massif Chimantá, along Río Asaporko, 1,300 m, 7 Jan. 1953, *Wurdack 34033A* (NY, US).

Hedyosmum intermedium Todzia, sp. nov. TYPE: Venezuela. Amazonas: Depto. Atures, Sierra Maigualida, NW sector, small valley along an upper tributary of Caño Iguana, 5°30′N, 65°15′W, 2,000 m, 28 Feb.–3 Mar. 1991, *Berry, Huber & Rosales 4913* (holotype, TEX; isotypes, MO, MYF not seen, VEN not seen). Figure 1.

Inter *Hedyosmum neblinae* ac *H. gentryi* intermedium; *H. neblinae* similis dispositionibus florum ac cymularum sed foliis ellipticis et vaginis foliorum glabris differt; *H. gentryi* similis foliis ellipticis ac vaginis foliorum glabris sed cymulis floribus 2–3 instructis differt.

Dioecious, aromatic trees or shrubs 1.5–8 m tall; young stems quadrate, sometimes dull red; older stems terete with tubular leaf bases persisting, ultimately disintegrating and leaving circular scars; internodes 1–7 cm long. Leaves elliptic, 6–14 cm long, 2.3–6.4 cm wide with abruptly acuminate apices 0.5–1.2 cm long, attenuate at base, at margins coarsely serrate with teeth 5–8 mm distant,

glabrous, drying subcoriaceous and smooth; midvein glabrous beneath; larger lateral veins 10–14, 7–10 mm distant, obscure, leaving midvein at ca. 90° angle, arcuate toward margin, free portion of petioles 0.4–1.8 cm long, glabrous; petiolar sheaths 0.8–1.1 cm long, 0.6–0.9 cm broad at apex, slightly flared at apex, glabrous, smooth; stipular appendages linear, ca. 2 mm long, caducous. Staminate inflorescences 5.5–11 cm long, composed of racchises with 1–4 nodes with 1–3 spikes per node; mature spikes 1–2 cm long, subtended by 2–4 ovate bracts; stamens ca. 130–200, congested on axis, ca. 1.5 mm long, ca. 1 mm broad at apex, connective ca. 0.3 mm long, flattened distally. Pistillate inflorescences axillary or terminal, simple or basally branched racemes 3–4 cm long; cymules with 2–3 flowers, opposite on inflorescence axis, 4–10 mm distant, sessile; subtending floral bracts 2.5–4 mm long, free almost to base or connate in lower one-fourth, acute at apex, margin ciliate. Pistillate flowers strongly trigonous, 3–4 mm long, 1–2 mm broad on each face, with a large pore on each face of the ovary; perianth lobes minute, deltoid, rounded at apex. Fruiting cymules red to purple; seeds ca. 4 mm long, strongly trigonous, minutely papillose.

Distribution, habitat, and phenology. Widespread in the Venezuelan Guayana, occurring in semi-open and medium-height forest, savannas, and stream and river edges between 1,200 and 2,000 m. Flowering specimens have been collected in February, March, and October, while fruiting is reported in March and October.

Numerous recent expeditions in the Venezuelan Guayana have provided sufficient material to assess these populations that were originally placed in *Hedyosmum gentryi* (Todzia, 1988). Along with *H. gentryi*, *H. neblinae*, and *H. pseudoandromeda*, *H. intermedium* is one of the few purple-fruited species in subgenus *Tafalla* sect. *Microcarpa*. *Hedyosmum intermedium* is morphologically intermediate between *Hedyosmum gentryi*, which ranges from eastern Panama (Darién) and northern Colombia (Antioquia) to northern Venezuela (Aragua, Falcón, Mérida, Miranda, Monagas, Portuguesa, and Yaracuy), and *H. neblinae* (known only from Cerro Neblina, which is further south than the localities presently known for *H. intermedium*). *Hedyosmum intermedium* has a flower and cymule arrangement similar to *H. neblinae*, but differs from it by glabrous (vs. verrucose) leaf sheaths and elliptic (vs. ovate) leaves. It shares with *H. gentryi* elliptic leaves and glabrous leaf sheaths, but differs in having 2–3 flowers per cymule (vs. 1 flower per cymule).

Paratypes. VENEZUELA. AMAZONAS: Serranía Parú, Caño Asisa, Río Ventuari, 2,000 m, 7 Feb. 1951, *Cowan & Wurdack 31336* (NY); Depto. Atabapo, slope of Cerro Marahuaca, Río Yameduaka arriba, 3°38′N, 65°28′W, 1,225 m, 19 Feb. 1985, *Liesner 17665A* (MO, TEX, VEN); Depto. Atabapo, below Salto Los Monos on tributary of headwaters of Río Iguapo, 3°35′N, 65°23′W, 1,500–1,650 m, 12 Mar. 1985, *Liesner 18582* (MO, TEX, VEN); Depto. Río Negro, Cerro Aracamuni, summit, Proa camp, 1°32′N 65°49′W, 1,400 m, 27 Oct. 1987, *Liesner & Carnevali 22517* (MO, TEX, VEN), *Liesner & Carnevali 22535* (MO, TEX, VEN); Depto. Atabapo, Cerro Marahuaca, slopes, "Sima" area, 03°43′N 65°30′W, 1,200 m, 16 Oct. 1988, *Liesner 24961* (MO, TEX, VEN), 18 Oct. 1988, *Liesner 25068* (MO, TEX, VEN); Depto. Río Negro, Cerro Aracamuni, summit, Proa camp, 1°32′N 65°49′W, 1,400 m, 25 Oct. 1987, *Liesner & Carnevali 22438* (MO, TEX, VEN), 26 Oct. 1987, *Liesner & Carnevali 22472* (MO, TEX, VEN). BOLIVAR: Meseta del Jaua, Cerro Jaua, 1,820–1,880 m, 28 Feb.–5 Mar. 1974, *Steyermark et al. 109677* (A, K, NY); Distr. Cedeño, Meseta de Jaua, sector centro meridional, cabeceras del Río Marajano, afluente del Río Cácaro, 04°48′N, 64°32′W, 1,750–1,800 m, 20 Nov. 1989, *Huber 13048* (TEX).

Acknowledgments. I thank the curators at MO, NY, US, and VEN for sending *Hedyosmum* material for identification. I also thank Guy Nesom for the Latin diagnoses and Paul Berry for review of the manuscript.

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Jaimehintonia (Amaryllidaceae: Allieae), a New Genus from Northeastern Mexico

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ABSTRACT. A new genus and species, *Jaimehintonia gypsophila*, from gypseous soils of Nuevo Leon, Mexico, is described and illustrated. It belongs to the tribe Allieae of the family Amaryllidaceae, where it is most closely related to *Androstephium* and associated genera. It differs from most of these in having, in combination, coarsely tunicate bulbs, purple to pink perianths, and a well-developed hypanthium to which the gynoecium is not fused.

Continuing identification and curation of gypsophilic plants from Nuevo Leon, Mexico, has revealed the following novelty.

Jaimehintonia gypsophila B. Turner, gen. et sp. nov. TYPE: Mexico. Nuevo Leon: along highway 68, 15 mi. S of Ascension and 3.5 mi. NW of La Escondida, ca. 97 mi. N of Matehuala, steep exposed gypsum hill adjacent to the road, "associated with ferns, *Dalea* and *Agave*," 24 Sep. 1973, *James L. Reveal 3426*, with *N. D. Atwood* (holotype, TEX). Figure 1.

Herba bulbi tunicis grosse fibrosis. Folia basalia paene teretia 12–15 cm longa. Scapus 25–30 cm longus, umbellam apicalem florum 3–6 ferens, umbella bracteis 3–6 scariosis lineari-lanceolatis 3–5 mm longisque subtenta. Pedicelli 3–4 cm longi ad summum articulati. Hypanthium roseum vel purpurascens anguste tubulare in 10 mm basali, versus apicem gradatim dilatatum; tepala 6 expansa elliptica vel elliptici-oblanceolata 1-nervata 10–12 mm longa 3–4 mm lataque. Ovarium glabrum stipitatum hypanthio non adnatum.

Bulb turbinate with very coarse fibrous coat, ca. 3 cm long × 2 cm wide, not deeply buried, perhaps only 2–3 cm below the soil surface. Leaves 12–15 cm long, 1.0–1.5 mm wide, terete or somewhat 4-sided in cross section (dried), glabrous, the angles adorned with minute clear pustulate cells, these arranged in lines. Scapes naked, terete, 25–30 cm long, glabrous, except for very scattered minute recurved callosities. Flowers 3–6 to an inflorescence, arranged in an apical umbel, the base of the umbel subtended by 3–6 linear-lanceolate scarious bracts 3–5 mm long. Pedicels 3–4 cm long. Hypanthium reportedly "purple to pink or rarely white," tubular below for about 10 mm, then gradually flaring to the apex, the hypanthium or fused portion 16–20 mm long, 4–6 mm wide at the top, the tepals elliptic to elliptic-oblanceolate, somewhat spreading, 10–12 mm long, 3–4 mm wide, 1-nervate, the apices obtuse to rounded. Stamens 6, the filaments ca. 8 mm long, united below into a short scarious tube ca. 1 mm long; anthers basifixed, yellow, ca. 2.1 mm long. Ovary glabrous, elliptic, ca. 4 mm long, 2 mm wide, borne on a free stipe 8–12 mm long; style somewhat longer than the filaments, the stigma ± capitate. Capsule ellipsoid, 8–10 mm high, 3–4 mm wide, 3-valvate, each carpel containing ca. 16 seeds. Seeds irregularly quadrate, black, the surfaces finely muricate (40×).

This remarkable plant was first called to my attention by the Hinton collection cited below. I struggled for an identification of the specimen, which lacked below-ground parts. In a search through sundry genera housed in the collection at LL, TEX, I came upon another collection of the taxon by James Reveal among the unidentified materials of the Liliaceae, one that had a tunica-covered bulb and well-preserved flowers.

Superficially, the two specimens are similar to *Androstephium coeruleum* (Scheele) Torrey, having pedicels jointed at the summit, the perianth segments united into a distinct hypanthial tube, and the stipitate ovary not fused with the hypanthium. They lack, however, the prominent corolla tube or corona of that species. They appear closely related to *Androstephium* and cohorts, keying to this group in Moore's (1953) synoptical key to the American genera of the Allieae; among these (*Androstephium*, *Bloomeria*, *Brodiaea*, *Dichelastemma*, *Muilla*, *Triteleia*, *Triteleiopsis*), I could find no satisfactory genus in which to position the present novelty. The species of this group appear to be apportioned among genera (as currently accepted) distinguished by rather small differences. Such also appears to be true for the Allieae in general. Without a comprehensive study of the tribe, however, and the identification of groups that perhaps are more natural, the new species described here cannot be placed to genus. Its recognition as a monotypic genus is in keeping with current classificatory trends.

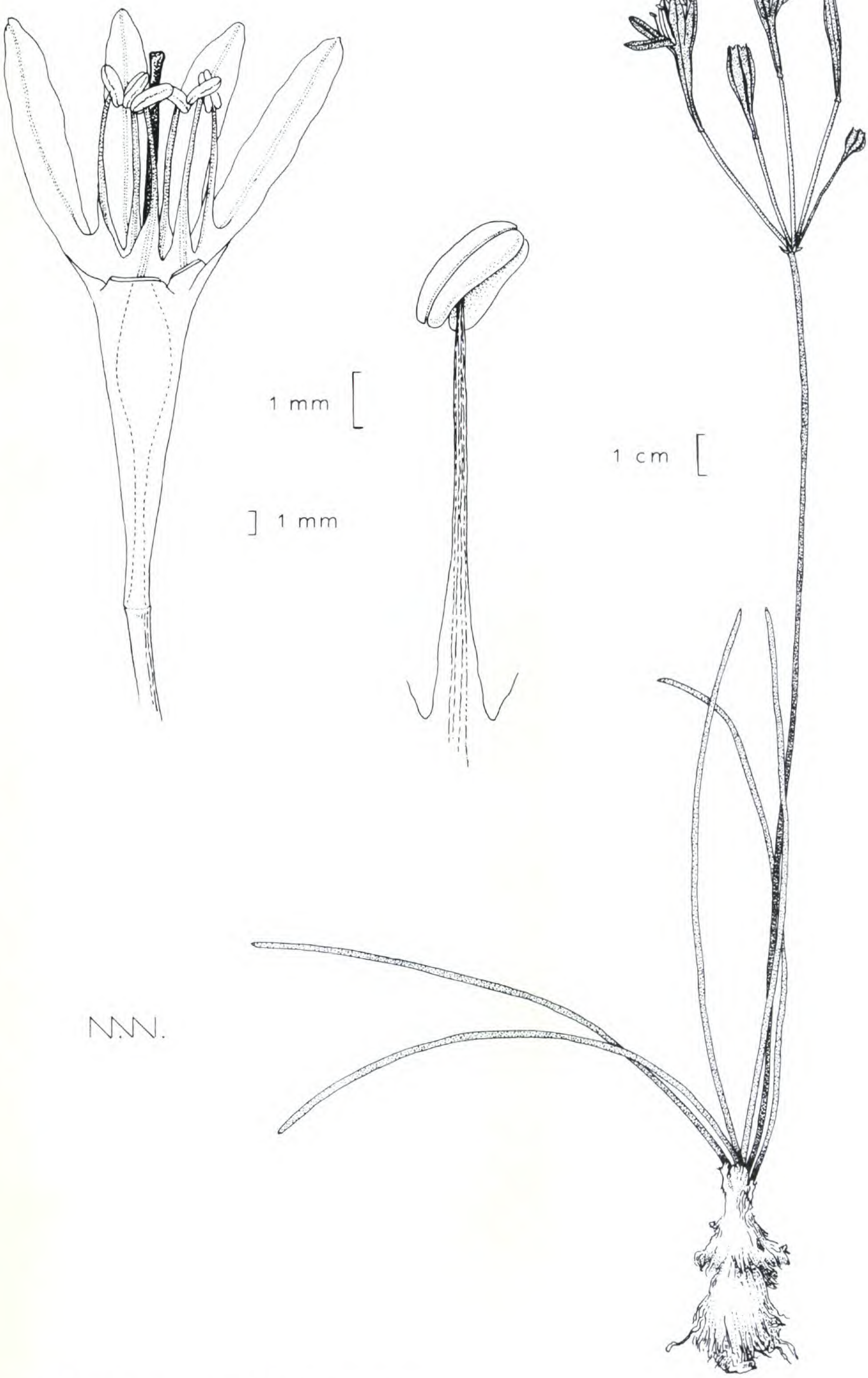

Figure 1. *Jaimehintonia gypsophila*, from the holotype.

Jaimehintonia is similar to the recently described *Milla mortoniana* H. E. Moore (1953), having the blue (or purplish on drying) perianth and remarkably similar umbellate inflorescence, but it lacks the androecial and gynoecial features of that species (cf. Moore's illustration, 110 B).

I take pleasure in naming the genus for Jaime Hinton, son of the late George B. Hinton, whose early collections from the Pacific slopes of Mexico are well known (Hinton & Rzedowski, 1972). Jaime is a Mexican citizen and, along with his wife, son George, and grandson, now resides on the western lower slopes of Cerro Potosi near the village of San Rafael on his "Rancho Aquillilla." The most remarkable attribute of Jaime, in my opinion (as opposed to most nonacademic people of my acquaintance), is his exceptional dedication to things botanical. He revealed to me once (following a question put to him regarding this matter) that one of the happiest periods of his life had to be the several years he spent enduring the rugged terrain and difficult conditions collecting plants with his father, mostly in western Mexico and Guerrero. Proof of that has been his continued zeal in pursuing similar fieldwork in the mountainous terrain of northeastern Mexico with his son George; more recently, both have been joined by the latter's son, making this a four-generation operation, all of their collection numbers having been extended from those of George the elder, hence the collector's notation, *G. B. Hinton et al.*

Paratype. MEXICO. NUEVO LEON: Mpio. Aramberri, gypsum hillsides, Aramberri, 1,145 m, 1 Sep. 1990, *G. B. Hinton et al. 20560* (TEX).

Acknowledgments. I am grateful to Guy Nesom for the Latin description and to him and T. P. Ramamoorthy for reviewing the manuscript. Nancy Webber provided the illustration.

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A New Species of *Oplonia* (Acanthaceae) from Southern South America

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ABSTRACT. A new species of *Oplonia* from the province of Jujuy, Argentina, *O. jujuyensis*, is described, illustrated, and compared with its closest relative. It differs markedly from *O. hutchisonii* by the corolla, which is weakly zygomorphic, and by the erect limb, with the posterior lip deeply two-lobed. This is the first report of this genus from Argentina.

The present study of the Acanthaceae for the flora of the Province of Jujuy, Argentina, has led to the recognition of a new species of *Oplonia* from that region. The genus belongs to the subfamily Acanthoideae tribe Odontonemeae in accordance with Lindau's (1895) infrafamilial classification of the Acanthaceae, or in the tribe Justicieae subtribe Odontoneminae if one prefers to follow Bremekamp's (1965) system of subfamilial classification. It is characterized by flowers that are either solitary in the leaf axils or borne in comparatively few-flowered axillary fascicles with minute bracts. This much reduced inflorescence distinguishes *Oplonia* from *Odontonema* Nees, the latter of which has flowers borne in terminal racemes or panicles. The corolla is zygomorphic, occasionally only weakly so, with a slender tube and a two-lipped limb, the posterior lip is two-lobed and the anterior lip is three-lobed. There are two stamens, which may be exserted or included, and two staminodes. Presently, two species are known from northern Peru, eight from the West Indies, and five from Madagascar. This is the first time that the genus is reported from Argentina.

Although the genus *Oplonia* is easily recognized and defined, the delimitation and distribution of the taxa are more complex and somewhat unusual. Most species grow in dry open habitats as part of scrub forest. The new taxon is found in thicket of transitional forest between the Chaco and Yungas (sensu Cabrera, 1976). The evolution of the genus (Stearn, 1971) would appear to be from a mesophytic spineless South American ancestor, resembling the small-flowered species of *Odontonema*, by progressive reduction in leaf size, by the contraction of the inflorescence from a narrow panicle or raceme into a few-flowered axillary fascicle or solitary flower, and by the conversion of lateral branches into spines, by which changes they became xerophytic. We believe that *Oplonia jujuyensis*, with its reduced leaves, an inflorescence of few flowers in axillary fascicles, small, *Odontonema*-like flowers, and habitat represents an isolated transition between the genera *Odontonema* and *Oplonia*.

Oplonia jujuyensis Wasshausen & Ezcurra, sp. nov. TYPE: Argentina. Jujuy: Depto. Ledesma, Parque Nacional Calilegua, near the road to Mesada de las Colmenas, 850 m, 9 Aug. 1985, *Iudica & Ramadori 91* (holotype, SI). Figure 1A–E.

Frutex vel suffrutex, 1.5 m altus, ramosus, inermis, caulibus teretibus cupraceis vel pallidis nitidis cortice exfoliato; foliorum laminae ovato-ellipticae 4–10 cm longae et 3–4 cm latae utrinque attenuatae glabrae; floribus axillaribus fasciculatis, geminis ternisve brevissime pedicellatis; bracteolis 1–2 mm longis subulatis brevibus; corolla alba late tubulosa 15 mm longa, labis subaequalibus, superiore profunde bilobato, lobis ovatis vel obovatis, inferiore prope basim trilobato, lobis superioribus similibus leviter latioribus; staminibus sterilibus brevibus; capsula ignota.

Branching shrub or subshrub to 1.5 m high; stem erect, cylindrical, the bark pale or copper-colored, exfoliating, glabrous, with prominent leaf scars; spines absent; leaves opposite, petiolate, the lower leaves often fascicled and on short axillary branches, reduced, deciduous toward base, the blades elliptic-ovate, 4–10 cm long, 3–4 cm wide, acute and acuminate, narrowed at the base and decurrent on the petiole, membranous, entire or undulate, glabrous, the cystoliths prominent under a lens; petiole 10–13 mm long; flowers 2–3 in sessile dichasia,

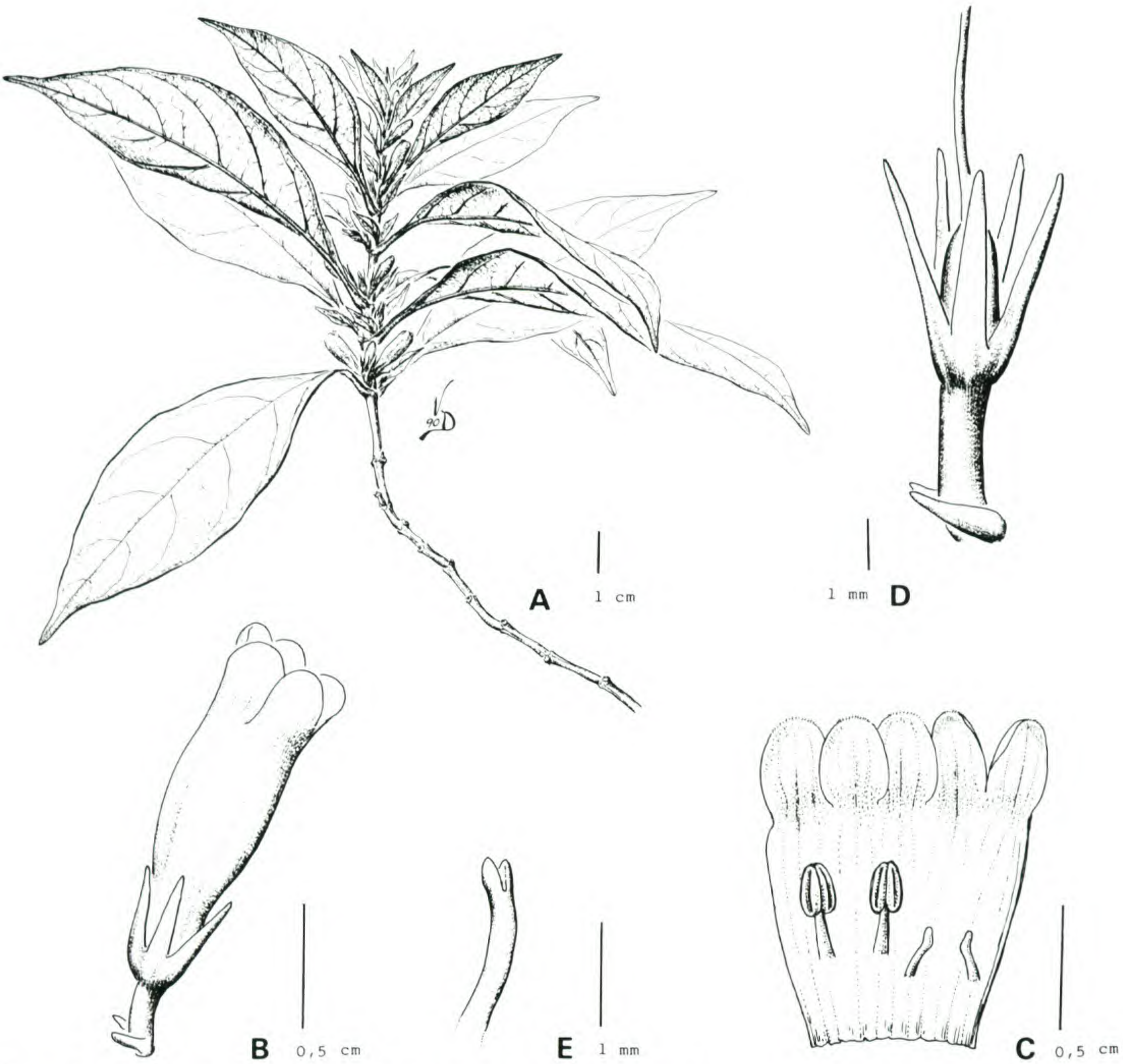

Figure 1. A–E. *Oplonia jujuyensis* (*Iudica & Ramadori 91*). —A. Habit. —B. Bracteoles, calyx segments, and corolla. —C. Corolla expanded, stamens, and staminodes. —D. Bracteoles, calyx segments, ovary, and style. —E. Portion of style and stigma.

occasionally reduced to 1 flower subtended by 2 bracteoles, borne in the axils of the upper leaf blades; bracteoles triangular, small, 1–2 mm long, glabrous or puberulous; calyx 3–4 mm long, the segments linear, ca. 3 mm long, 1 mm wide, subulate, puberulous or glabrous; corolla white, tubular, puberulent within at the base of the tube, glabrous without, 15 mm long, the tube 12 mm long, 1 mm wide at the base, gradually expanded to 3.5–4 mm diam. at the throat, the limb erect, the posterior lip deeply 2-lobed with the lobes ovate to obovate, 3 mm long, 1.6–2.2 mm wide, obtuse or rounded at apex, ciliate along the margins, the anterior lip similar only the lobes slightly larger, 2.2–2.5 mm wide; stamens included, inserted near the middle of the corolla tube; filaments 2.5 mm long, glabrous; anthers 1.5 mm long, the thecae subequal, muticous; pollen grains spheroid, 36 × 33 μm, 3-colporate, each colpus flanked by 2 pseudocolpi, pitted with minute lumina (Fig. 2A–B); staminodes 2, minute, 1–2 mm long; ovary glabrous, 2 mm long; stigma slightly bifid. Capsule wanting.

Distribution. Growing in thicket of foothills of transitional forest between the Chaco and Yungas.

Oplonia jujuyensis is not closely allied to the other known species of *Oplonia*. It is perhaps nearest in relationship to *O. hutchisonii* Wasshausen from the Department of Amazonas, Peru; however, this species is unique in that the corollas are much smaller (8–8.5 mm long), strongly zygomorphic with the posterior lip shallowly two-lobed and the lobes

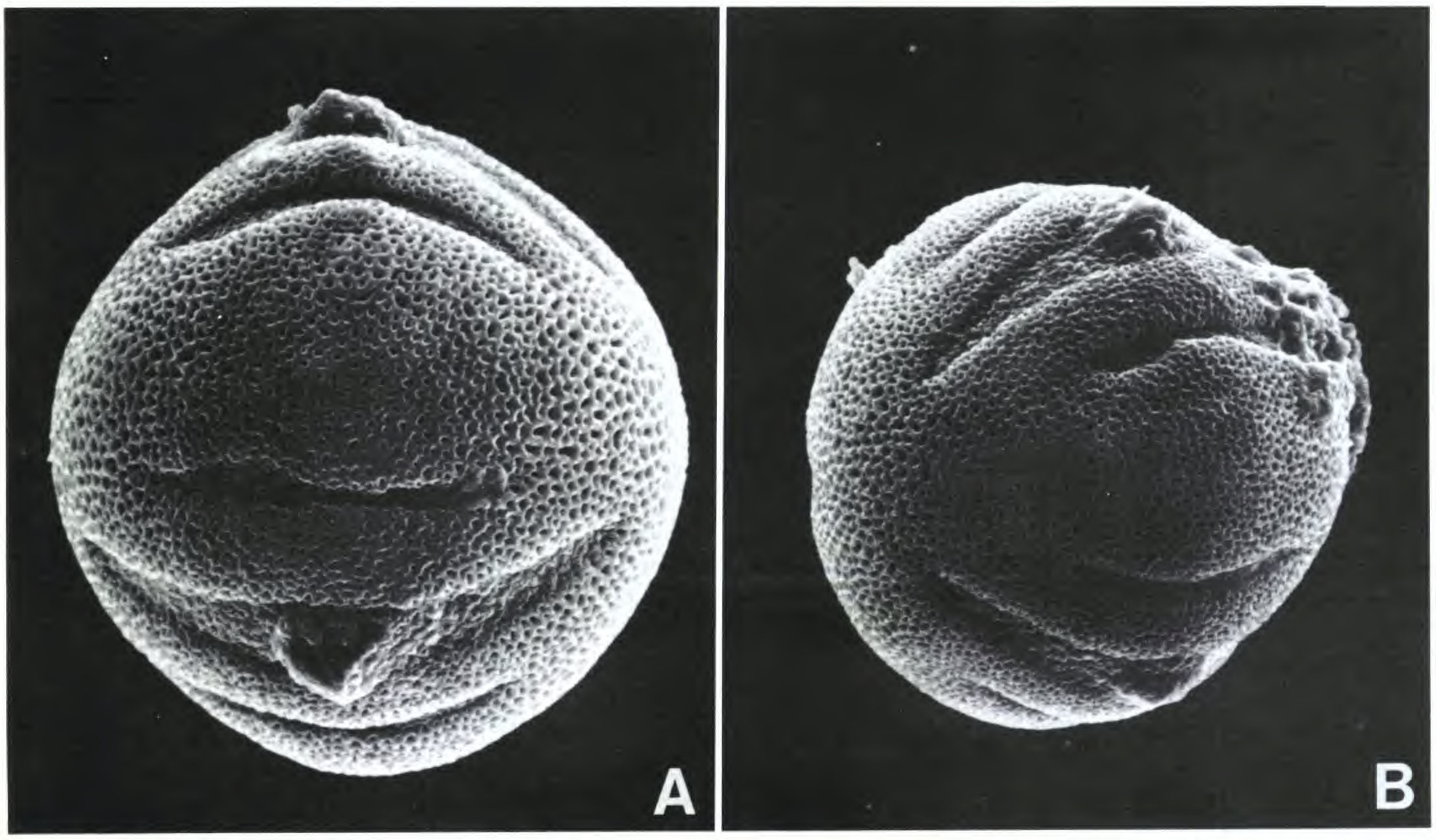

Figure 2. A, B. Scanning electron (SEM) photomicrograph of *Oplonia jujuyensis* (*Iudica & Ramadori 91*). —A. Equatorial view, ×1,700. —B. Polar view, ×1,500.

of the anterior lip spreading, 7–15 flowers are borne in sessile axillary fascicles, and the pollen grains are prolate, 66 × 36 μm, not distinctly pitted with minute lumina. In contrast, *O. jujuyensis* has corollas 15 mm long, these weakly zygomorphic with the posterior lip deeply two-lobed and the lobes of the anterior lip erect, 2–3 flowers are borne in sessile axillary fascicles, and the pollen grains are spheroidal, 36 × 33 μm, distinctly pitted with minute lumina.

Paratype. ARGENTINA. SALTA: Depto. Gral. San Martín, Quebrada de Capiazuti, *Schulz & Varela 5378* (CTES).

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A New Combination in *Pottia* (Musci)

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ABSTRACT. *Pottia fosbergii*, of the southwestern United States and Mexico, is recognized at the varietal level: *P. starkeana* var. *fosbergii*.

While working on the genus *Pottia* for the forthcoming *Moss Flora of Mexico* (Sharp et al., in press), I found that plants referable to *Pottia fosbergii* E. B. Bartram usually occur in mixture with *P. starkeana* (Hedwig) C. Müller subsp. *starkeana* and may actually be hybrids between *P. starkeana* and another species. The operculum is usually undifferentiated and the peristome absent, but a Californian specimen that is clearly *P. fosbergii* (*Ikenberry 369*, CANM), called to my attention by Terry McIntosh, has a weakly differentiated operculum and rudimentary peristome teeth. The gametophytes of both the above taxa are essentially identical. *Pottia fosbergii* should henceforth be recognized at the varietal level, as it differs from *P. starkeana* only in the operculum weakly differentiated or not differentiated, and the peristome absent or rudimentary.

Pottia starkeana var. **fosbergii** (E. B. Bartram) R. H. Zander, comb. et stat. nov. Basionym: *Pottia fosbergii* E. B. Bartram, Bryologist 33: 18. 1930. TYPE: U.S.A. California: Los Angeles Co., Claremont, *Fosberg D24* (holotype, FH).

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Lepidium tayloriae (Brassicaceae), a New Species from Chile

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ABSTRACT. *Lepidium tayloriae* from Atacama (Region III), Chile, is described and illustrated. Its relationship to *L. pseudodidymum* and *L. strictum* is discussed, and its distinguishing characters from these and other South American species are given.

Several South American species of *Lepidium* have been discovered since Hitchcock's (1945) revision, and the total number, including this new species and *L. peruvianum* Chacón (1990), bring the total estimate of Al-Shehbaz (1989) to 52 species. The South American species of *Lepidium* belong to several complexes (e.g., *L. abortanifolium* Turczaninow, *L. aletes* Macbride, *L. chichicara* Desvaux, *L. depressum* Thellung, and *L. meyenii* Walpers), the taxonomy of which requires critical study. The limits of component species of a given complex are sometimes obscure. As shown below, however, the new species and its relatives are readily distinguished from all the other South American lepidiums.

Lepidium tayloriae Al-Shehbaz, sp. nov. TYPE: Chile. Atacama (Region III): Copiapó Province, between Huasco and Copiapó, ca. 20–25 km W of Totoral on the road to the coast, dry plains and hillside, 20°00′S, 70°50′W, 8 Oct. 1991, *C. M. Taylor, C. von Bohlen & A. Marticorena 10804* (holotype, MO; isotype, CONC). Figure 1.

Herba annua hirsuta 17–24 cm alta. Folia caulina infima pinnatisecta 2–4 cm longa, segmentis 0.2–0.5 mm latis; folia superma anguste linearia integra, 1–4 cm longa, 0.3–1.5 mm lata. Flos sepalis ovatis 0.6–1 mm longis; petalis filiformibus usque ad 0.2 mm longis; pedicellis fructiferis erectis 1.2–2 mm longis, anguste alatis. Fructus suborbicularis, medio secus replum subconstrictus et subdidymus, (3.4–)3.7–4 mm longus et latus, valvis alatis, manifeste reticulato-venosis.

Herbs annual, erect, 17–24 cm tall; branches many, ascending, moderately to densely hirsute with spreading trichomes to 0.5 mm long. Basal leaves not seen; lowermost cauline leaves pinnatisect, 2–4 cm long, hirsute; petiole winged, 0.5–1.5 cm long, to 1 mm wide; lateral lobes 3–6, narrowly linear, 2–6 × 0.2–0.5 mm; rachis as wide as petiole; uppermost leaves narrowly linear, entire, 1–4 cm long, 0.3–1.5 mm wide. Inflorescences ebracteate racemes, greatly elongated in fruit. Sepals ovate, 0.6–1 × 0.3–0.5 mm, glabrous or rarely sparsely hirsute, purplish, scarious at margin, usually falling off after fruit maturation; petals filamentous, to 0.2 mm long; stamens 2, the filaments white, ca. 0.6 mm long, the anthers ca. 0.2 mm long; nectar glands 4, toothlike, ca. 0.1 mm long. Fruiting pedicels 1.2–2 mm long, erect, subappressed to rachis, narrowly winged, hirsute. Fruit suborbicular, subdidymous, (3.4–)3.7–4 mm long and wide, prominently reticulate, winged, glabrous, emarginate at apex, truncate-rounded at base; wing encircling all fruit, ca. 0.6 mm wide at fruit apex; apical notch ca. 0.3 mm deep, ca. 0.6 mm wide; style absent; stigma entire. Seeds ovate, brown, ca. 2 × 1 mm; cotyledons incumbent.

Lepidium tayloriae, which is named after Charlotte M. Taylor, one of the collectors of the holotype, is most closely related to the Argentinian *L. pseudodidymum* and the Chilean *L. strictum* (S. Watson) Rattan. These three species are readily distinguished from all of the other South American lepidiums by the prominently reticulate-veined fruits. The new species differs from *L. pseudodidymum*

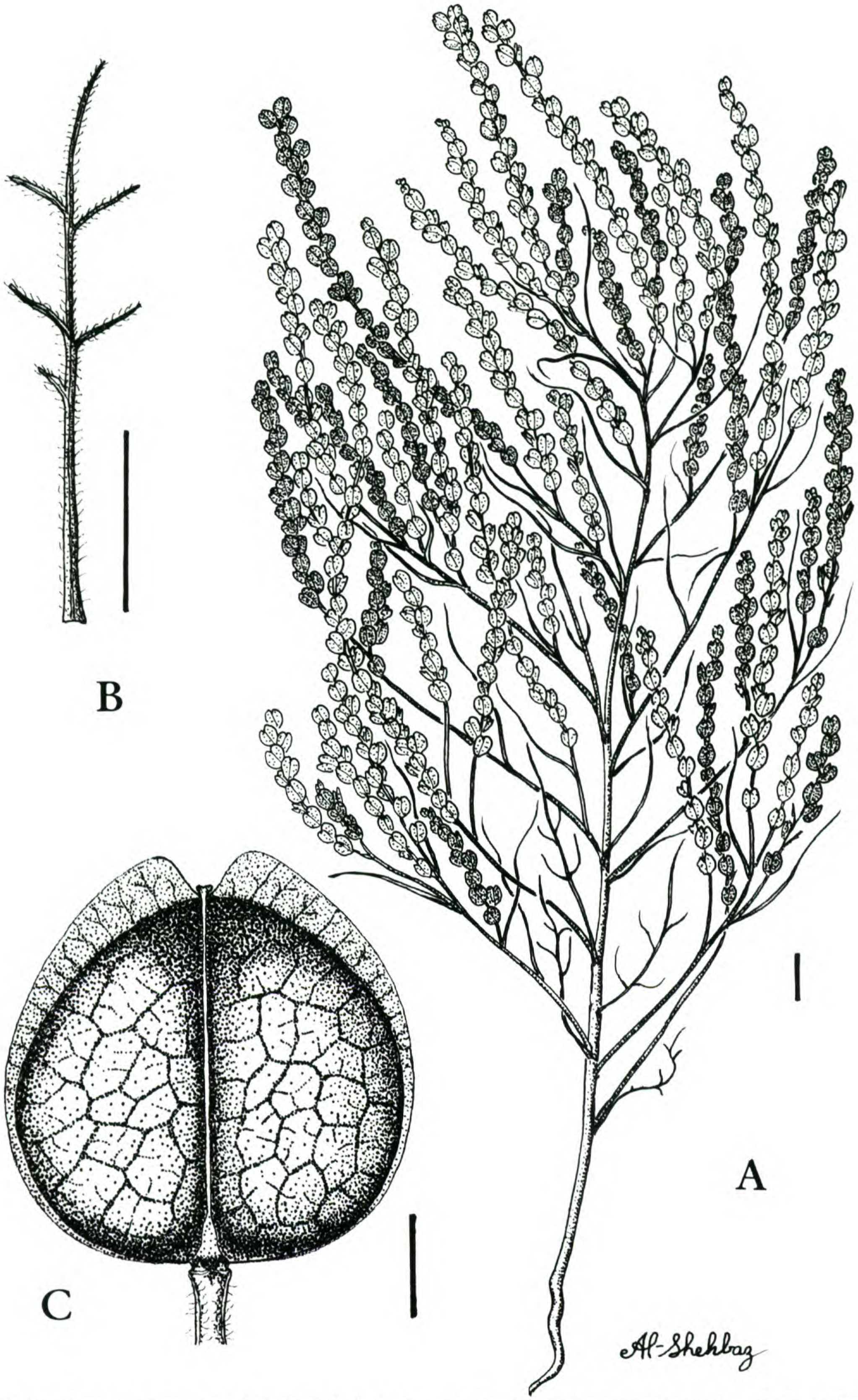

Figure 1. *Lepidium tayloriae* Al-Shehbaz (holotype). —A. Plant. —B. Lower cauline leaf. —C. Fruit. Scales A, B = 1 cm; C = 1 mm.

by its winged fruits (3.4–)3.7–4 mm long and wide, erect fruiting pedicels, entire upper cauline leaves, and sessile stigma. By contrast, *L. pseudodidymum* has wingless fruits 2–2.6 × 2.2–3 mm, arcuate-spreading fruiting pedicels, 2- or 3-pinnatifid or -pinnatisect upper cauline leaves, and styles ca. 0.17 mm long. It is separated from *L. strictum* by its larger fruits with glabrous keel, toothlike nectar glands, entire upper cauline leaves, trichomes to 0.5 mm, and constricted fruit replum distinctly lower than the valve surface. *Lepidium strictum* has smaller fruits (2.5 × 2 mm) with puberulent keel, linear nectar glands, pinnatisect upper leaves, trichomes to 0.3 mm, and raised fruit replum higher than the valve surface.

Acknowledgment. I am grateful to Roy Gereau for checking the Latin description.

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Romanschulzia mexicana (Brassicaceae), a Remarkable New Species from Guerrero, Mexico

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ABSTRACT. *Romanschulzia mexicana* is described as new and illustrated. It is readily distinguished from all other 12 species of *Romanschulzia* by its fruiting pedicels and gynophores that are both very long and rather slender.

Romanschulzia O. E. Schulz is one of two genera of the Brassicaceae (Cruciferae) that are distributed exclusively at high altitudes in the tropics (Al-Shehbaz, 1984). The other genus is the African *Oreophyton* O. E. Schulz. *Romanschulzia* consists of 12 species distributed from central Mexico south into Panama at 1,800–3,300 m (Rollins, 1942, 1956, 1984). The genus belongs to the Thelypodieae Prantl, a tribe considered by some to include genera that appear to be "primitive" among the Brassicaceae (Cruciferae) (Al-Shehbaz, 1973, 1985; Rollins, 1956). Because of its exceptionally long gynophores and shrubby habit, the new species was thought to be a member of the Capparaceae and thus was sent to one of us (H. H. Iltis). Iltis identified it as an unknown *Romanschulzia* because of its long gynophore, as well as the presence of a complete septum and incumbent cotyledons not invaginated between the radicle and cotyledons; the latter both are characters typical of Brassicaceae and not Capparaceae–Cleomoideae. Although the single collection on which *R. mexicana* is based contains no flowers, the species is described because of its unique fruiting material.

Romanschulzia mexicana Iltis & Al-Shehbaz, sp. nov. TYPE: Mexico. Guerrero: Mun. Leonardo Bravo, Pedregal, 28 km by road WSW of Filo de Caballo, 10 June 1985, *W. Thomas & J. L. Contreras 3788* (holotype, NY; isotype, WIS; fragments, MEXU, UC). Figure 1.

Frutex scandens usque ad 2.5 m; folia petiolata lanceolata vel oblongo-lanceolata obscure denticulata, folia proxime infra racemos auriculata vel amplexicauli; pedicelli fructiferi tenuissimi, arcuati vel divaricati, 4–8 cm longi; gynophoro tenuissimo, 2–3.2 cm longo; fructus cylindricus, 2.5–4.1 cm longus; semina oblonga, uniseriata, 2.6–3.6 × 1–1.3 mm; cotyledones incumbentes.

Scandent shrubs to 2.5 m, glabrous throughout. Stems terete, green when young, becoming straw colored with age; lateral branches 3–10 cm long; pith solid. Lowermost leaves of lateral branches petiolate, lanceolate to oblong-lanceolate, 2.5–6 × 0.4–2.2 cm, cuneate at base, obscurely denticulate, acute at apex; leaves just below racemes sessile, auriculate to amplexicaul, with rounded to subacute basal lobes. Flowers not seen. Infructescences lax racemes, 3–7 cm long, terminating lateral branches; fruiting pedicels very slender, divaricate at base, strongly arcuate to straight, 4–8 cm long, 0.3 mm diam. Receptacle 1.2–2 mm diam.; nectar glands continuous, subtending bases of all filaments. Gynophore very slender, 2–3.2 cm long, ca. 0.3 mm wide, obscurely and longitudinally 4-striate or 4-winged. Fruit narrowly cylindrical, 2.5–4.1 cm long, 2–3 mm wide; valves acute at both ends, with a prominent midvein and conspicuously reticulate lateral veins; septum complete, thin, opaque, pushed to valves by seeds on other side; style absent; stigma entire, minute. Seeds narrowly oblong, brown, 2.6–3.6 × 1–1.3 mm, plump, uniseriately arranged in each locule, wingless, faintly and minutely reticulate, with a tiny appendage distally; cotyledons incumbent, that facing radicle smaller.

Distribution. Known only from the type material, collected in forests and pasture on karstic limestone at 1,800–1,900 m.

The relationship of *Romanschulzia mexicana* is not entirely clear. The shrubby habit in *Romanschulzia* is known only in another species, *R. apetala* Rollins, which is a narrow endemic of the Cordillera Talamanca, Prov. Cartago, Costa Rica, once collected by R. W. Holm and H. H. Iltis in 1949 (*Holm & Iltis 536*, MO). However, the latter, only

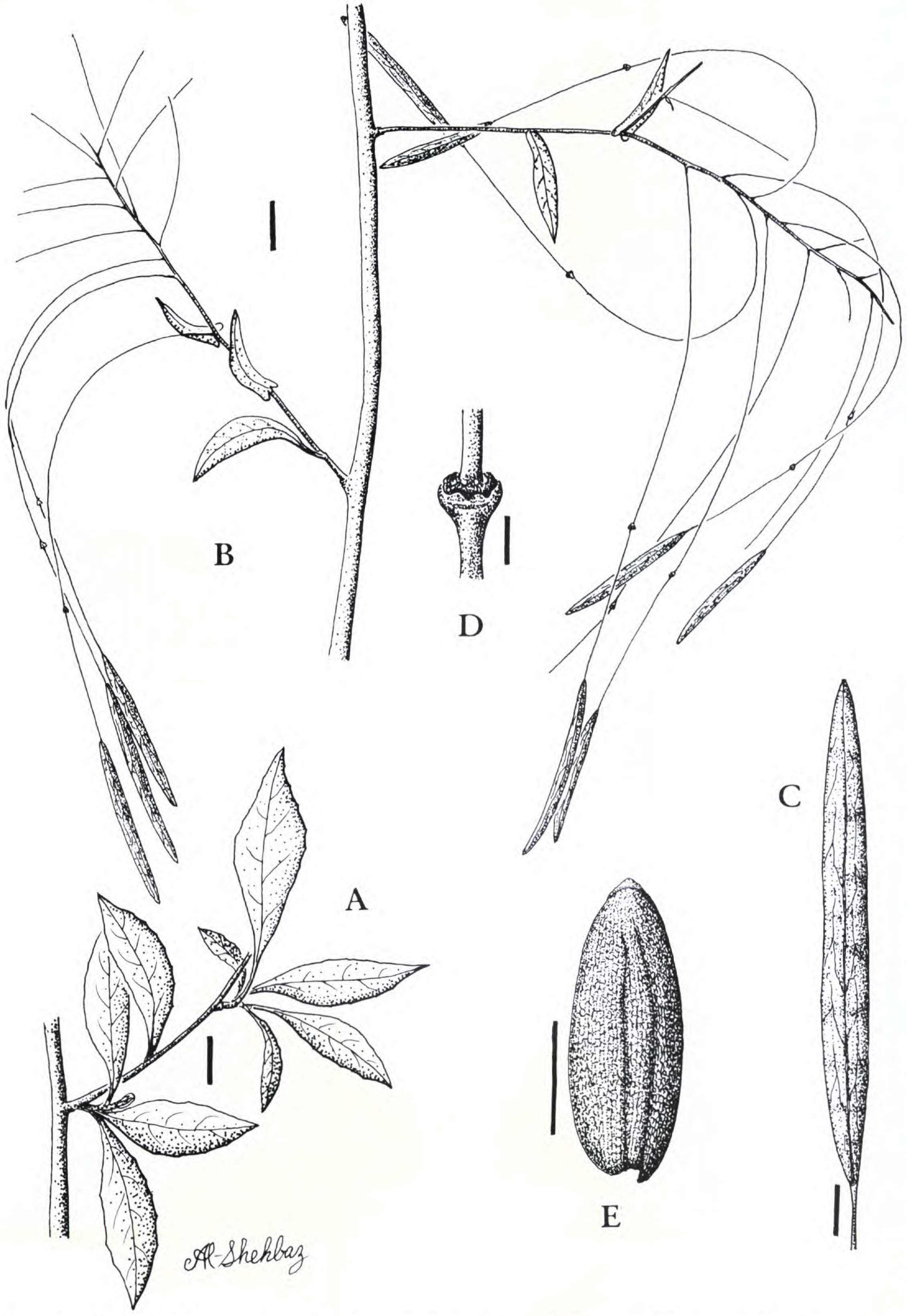

Figure 1. *Romanschulzia mexicana* Iltis & Al-Shehbaz (*Thomas & Contreras 3788*). —A. Lateral vegetative branch. —B. Infructescences. —C. Fruit. —D. Receptacle. —E. Seed. Scales A–C = 1 cm; D, E = 1 mm.

remotely related to *R. mexicana*, is readily distinguished from the new species by its long cauline leaves to 7 cm, flattened fruits, slender styles 4–5 mm, shorter gynophores 5–8 mm, biseriate seeds, and stout pedicels 1.5–2.5 cm.

Romanschulzia mexicana is easily separated from all other species of *Romanschulzia* by its very slender, arcuate to spreading fruiting pedicels 4–8 cm long, slender gynophores 2–3.2 cm long, prominently veined fruit valves, and sessile stigmas. In fact, the combination above of the very long and slender pedicels and gynophores is rather unique in the Brassicaceae, and the only other genus with such long gynophores, but with much shorter (0.4–2 cm) fruiting pedicels, is the western North American *Stanleya* Nuttall, another member of the tribe Thelypodieae.

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A New Species of *Xylopia* (Annonaceae) from Southern Venezuela

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ABSTRACT. *Xylopia plowmanii* is newly described from plants from Estado Apure and Estado Amazonas, Venezuela. It most closely resembles a group of emarginate-leaved species that includes *X. emarginata*, *X. spruceana*, and *X. venezuelana*.

During the preparation of the Annonaceae treatment for the upcoming *Flora of the Venezuelan Guayana*, the following new species of *Xylopia* was recognized and is described below.

Xylopia plowmanii P. E. Berry & D. Johnson, sp. nov. TYPE: Venezuela. Amazonas: Tobogán de la Selva, along Río Coromoto, 35 km S of Puerto Ayacucho, approximately 5°22′N, 67°33′W, *T. Plowman & F. Guánchez 13523* (holotype, MO; isotypes, F, NY, U). Figure 1.

Species *Xylopiae emarginatae* Martius, *X. spruceanae* Bentham et *X. venezuelanae* R. E. Fries proxima, differt vero: caulibus juvenilibus sparse adpresseque puberulentibus deinde subglabratis, foliis latioribus atque elliptico-oblongis, pagina inferiore glabris, excepta costa adpresse strigosa, calyce glabro leviter lobato, 2 mm longo, 3.5–4.5 mm lato, petalis exterioribus 14.5–18 mm longis, dorso inconspicue adpresso-pubescentibus, petalis interioribus 14–20(–24) mm longis.

Tree 12–16(–20) m tall. Leaf-bearing twigs 0.8–2.8 mm thick, brown to grayish brown, at first finely appressed-puberulent, later becoming glabrate, lenticellate. Blades of mature leaves 5–8 cm long, 2–3 cm wide, subcoriaceous, discolorous, oblong to elliptic-oblong, rounded and conspicuously emarginate at the apex, narrowed toward the base but angled sharply 2–4 mm from the petiole, making the base obliquely truncate, glabrous except for midrib, which is strigose abaxially with hairs 1–2 mm long; midrib impressed adaxially, raised abaxially; secondary veins faint, 7–9 per side, at 60–70° angle to midrib, slightly raised on both surfaces of the blade, anastomosing ca. 3 mm from the margin; petioles 3–4 mm long, 1.1–1.3 mm wide, terete, shallowly canaliculate and pubescent adaxially, glabrous abaxially. Flowers axillary, commonly two (sometimes three) per axil; inflorescence axis below articulation with pedicel 1–2.2 mm long, 1.1–1.3 mm thick; pedicel 2.8–4 mm long, 0.7–0.8 mm thick at midpoint, with an amplexicaul bract attached 1.2–1.5 mm above the articulation; bract 0.9–1 mm long, 1–1.3 mm wide, quadrate to semicircular. Calyx cuplike, 3.5–4.5 mm diam., divided to about the midpoint into broadly triangular lobes 1.5–2 mm long, glabrous. Petals pale yellow adaxially, orange except for the yellowish base abaxially; outer petals 14.5–18 mm long at maturity, 2 mm wide at midpoint, strap-shaped, widening to 3 mm at base, base concave, apex obtuse, densely puberulent adaxially, very sparsely appressed-puberulent abaxially; inner petals subequal in length to outer ones and similar in shape or exceptionally to 24 mm long, 1.2 mm wide at midpoint, 2 mm wide at base, puberulent along the midvein adaxially, uniformly puberulent abaxially. Stamens numerous, 1–1.4 mm long, 0.2–0.4 mm wide, the outermost ones converted into staminodes 0.9–1.2 mm long, 0.4–0.5 mm wide; connectives dome-shaped, short conic or truncate, papillate; filaments 0.4 mm long. Carpels 6–10, linear; ovaries 0.9–1 mm long, pubescent; style/stigma 4.2–4.8 mm long, linear, with a few sparse hairs along edges; ovules 4 in a single row. Torus in flower 2.1 mm diam., the stamens leaving raised scars on the torus surface, the center of the torus excavated, with the ovaries concealed within the cavity with only the styles exserted. Pedicel in fruit 10 mm long, 2 mm wide, glabrate. Monocarps 4–6, stipitate, the seed-containing portion 1.9–2.8 cm long, 1–1.8 cm wide, irregularly ovoid, densely covered by a matted, ferruginous indument, turning brown and glabrescent at maturity; stipes 4–7 mm long, 1.5–2 mm wide. Seeds usually 3 per monocarp, at 60° angle to long axis of monocarp, 6.5–7.5 mm long, 4–5 mm wide, ellipsoid, smooth; aril bilobed.

Distribution. Southern Estado Apure and northwestern Estado (formerly Territorio Federal) Ama-

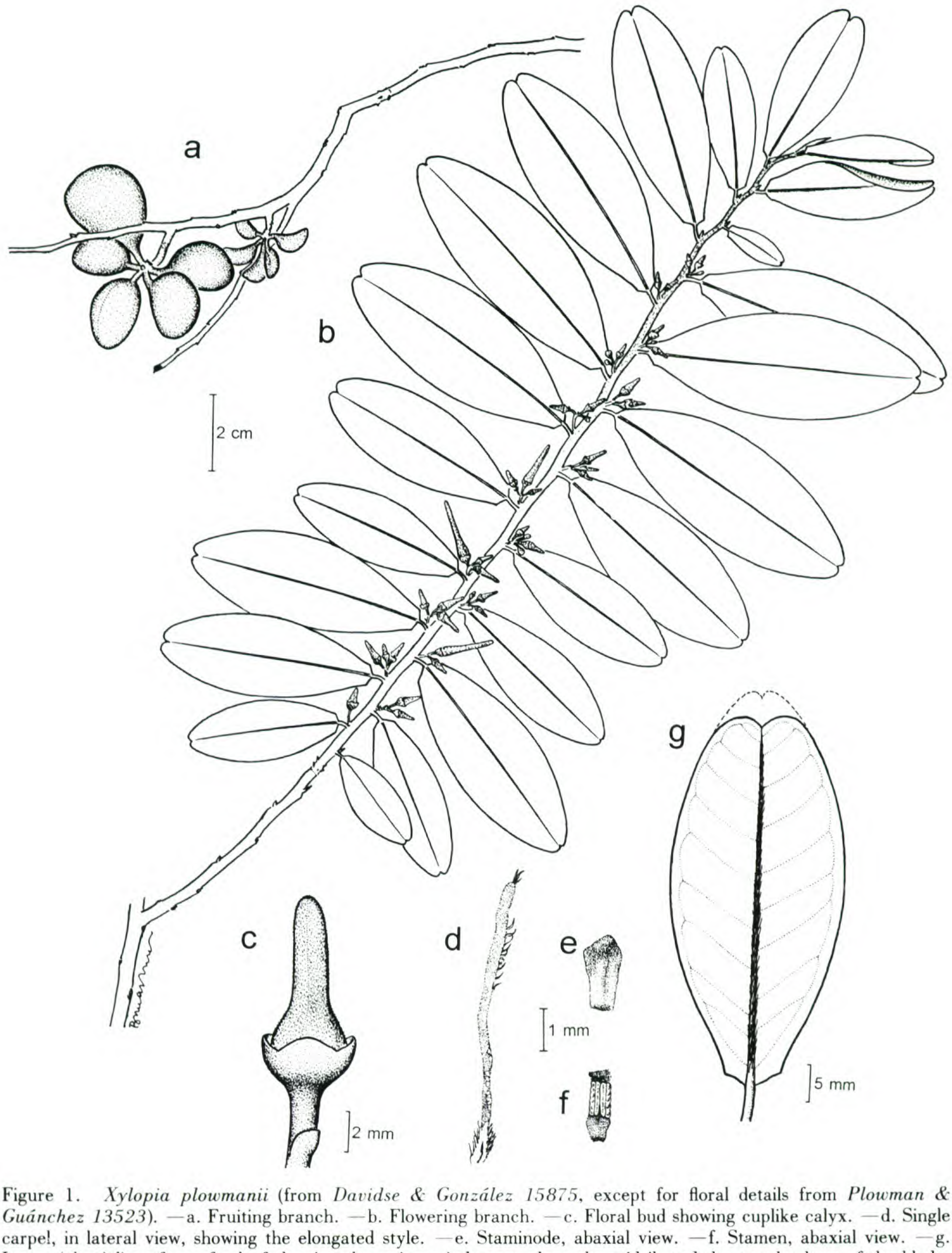

Figure 1. *Xylopia plowmanii* (from *Davidse & González 15875*, except for floral details from *Plowman & Guánchez 13523*). —a. Fruiting branch. —b. Flowering branch. —c. Floral bud showing cuplike calyx. —d. Single carpel, in lateral view, showing the elongated style. —e. Staminode, abaxial view. —f. Stamen, abaxial view. —g. Lower (abaxial) surface of a leaf showing the strigose indument along the midrib and the angular base of the blade.

zonas, Venezuela, 75–550 m elevation, in gallery forests and on forested slopes along granite outcrops.

This species resembles the species group of *Xylopia emarginata* Martius, *X. spruceana* Bentham, and *X. venezuelana* R. E. Fries, which are characterized by relatively small flowers and somewhat leathery, emarginate leaves. It differs from them mainly in the broader, chartaceous (vs. coriaceous) leaves and the relatively glabrous outer petals. Although occasionally found in other members of the

"emarginata" group, the leaves consistently have a prominent, angular projection toward the base and a strigose abaxial surface of the midrib. This species is dedicated to the late Timothy Plowman, who was an extremely knowledgeable and enthusiastic neotropical botanist.

Paratypes. VENEZUELA. **Amazonas:** Serranía Batata, 2 km al NE del Salto Colorado, 55 km SE de Puerto Ayacucho, 5°33′N, 67°08′W, 550 m, *Sanoja et al. 3327* (MO, PORT). **Apure:** Distrito Pedro Camejo, Caño (or Morichal) El Caballo, 16 airline km NW of Mata de Guanábana, between the Río Meta and the Río Cinaruco, 6°19′N, 68°19′W, elev. 75 m, 27 Feb. 1979 (fr), *G. Davidse & A. González 15875* (MO, U, VEN).

New or Noteworthy Orchids for the Venezuelan Flora IX: New Taxa, New Records, and Nomenclatural Changes, Mainly from the Guayana Shield and Northern Amazonas

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ABSTRACT. Research on the Orchidaceae of the Venezuelan Guayana and neighboring areas has yielded several novelties, new records, and nomenclatural changes. Nine species (one *Dichaea*, two *Lepanthes*, one *Maxillaria*, three *Pleurothallis*, one *Sarcoglottis*, and one *Uleiorchis*), a natural hybrid in *Maxillaria*, and two subspecies (one *Myoxanthus* and one *Stelis*) are newly described. New synonymies are proposed in *Campylocentrum*, *Habenaria*, and *Octomeria*. In addition, several miscellaneous country records are reported. Fifteen of the taxa presented are illustrated.

Continued studies related to the orchid treatment for Steyermark et al.'s *Flora of the Venezuelan Guayana* have yielded several novelties and nomenclatural changes for the orchid flora of the area and from other parts of the Neotropics. These novelties have resulted from the study of material received from several recent expeditions or from the study of critical material mainly at the Orchid Herbarium of Oakes Ames (AMES), the Herbario Nacional de Venezuela (VEN), and the Missouri Botanical Garden (MO). The taxa are arranged alphabetically by subfamilies, subtribes, and genera, following Dressler (1990).

SUBFAMILY CYPRIPEDIOIDEAE

Selenipedium steyermarkii Foldats, Bol. Soc. Venez. Ci. Nat. 21: 254, fig. 1. 1961.

This species was recently collected for the first time outside Venezuela, extending its range into Guyana.

Specimens examined. GUYANA. **Potaro–Siparuni Region:** summit of Mt. Kopinang, 5°00′N, 59°55′W, 1,700–1,800 m, 8 Apr. 1988, *Hahn, Judziewicz & Gopaul 4392* (MO, US).

SUBFAMILY EPIDENDROIDEAE

SUBTRIBE ANGRAECINAE

Campylocentrum hondurense Ames, Sched. Orchid. 5: 37. 1923. TYPE: Honduras. Lancetilla Valley near Tela, 250 ft. altitude, 16 Mar. 1923, *Ames II 210* (holotype, AMES). Figure 1.

Campylocentrum steyermarkii Foldats, Act. Bot. Venez. 3: 316, f. 4. 1968, syn. nov. TYPE: Venezuela. Táchira: El Piñal, Río Frío, 250–300 m, 27 Aug. 1966, *Steyermark & Rabe 96715* (holotype, VEN).

Campylocentrum steyermarkii was based on a specimen in young buds with not fully developed spurs; otherwise it is identical to the type of *C. hondurense*. We have seen living material collected close to the original locality that confirms this idea. Recently *C. hondurense* has been collected in the Amazon Basin in Venezuela and Peru; this is the first record of this species for Peru. The species is now known from Honduras, Belize, Venezuela, and Peru. It is apparently always cleistogamous.

Specimens examined. PERU. **Madre de Dios:** Tambopata, Cuzco Amazónico, Lodge Camp site 1, Plot E, 200 m, 14 June 1989, *Núñez et al. 11029* (MO). VENEZUELA. **Territorio Federal Amazonas:** Río Mavaca, 1°59′N, 65°6′W, ca. 200 m, 23 Mar. 1988, *Ramírez & Laskowski 246* (VEN).

SUBTRIBE DICHAEINAE

Dichaea venezuelensis Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Bolívar: Distrito Piar, Amarway-tepui, S side, forest 5–25 m tall, 700–910 m, 28 Apr. 1986, *Liesner & Holst 20477* (holotype, VEN; isotype, MO). Figure 2.

(Species) *D. riopalenquensi* Dodson verosimiliter affinis sed floribus minoribus, sepalis 5–6 mm longis (vs. 8 mm), petalis 4.5 mm longis, 2 mm latis (vs. 8 × 3 mm) et labello proportione latiore, 4.5 mm longo, 5.5 mm lato (vs. 9 × 7 mm) differt. *Dichaeam cleistogamam* Dodson in mentem revocans sed foliis sepalisque angustioribus recedit.

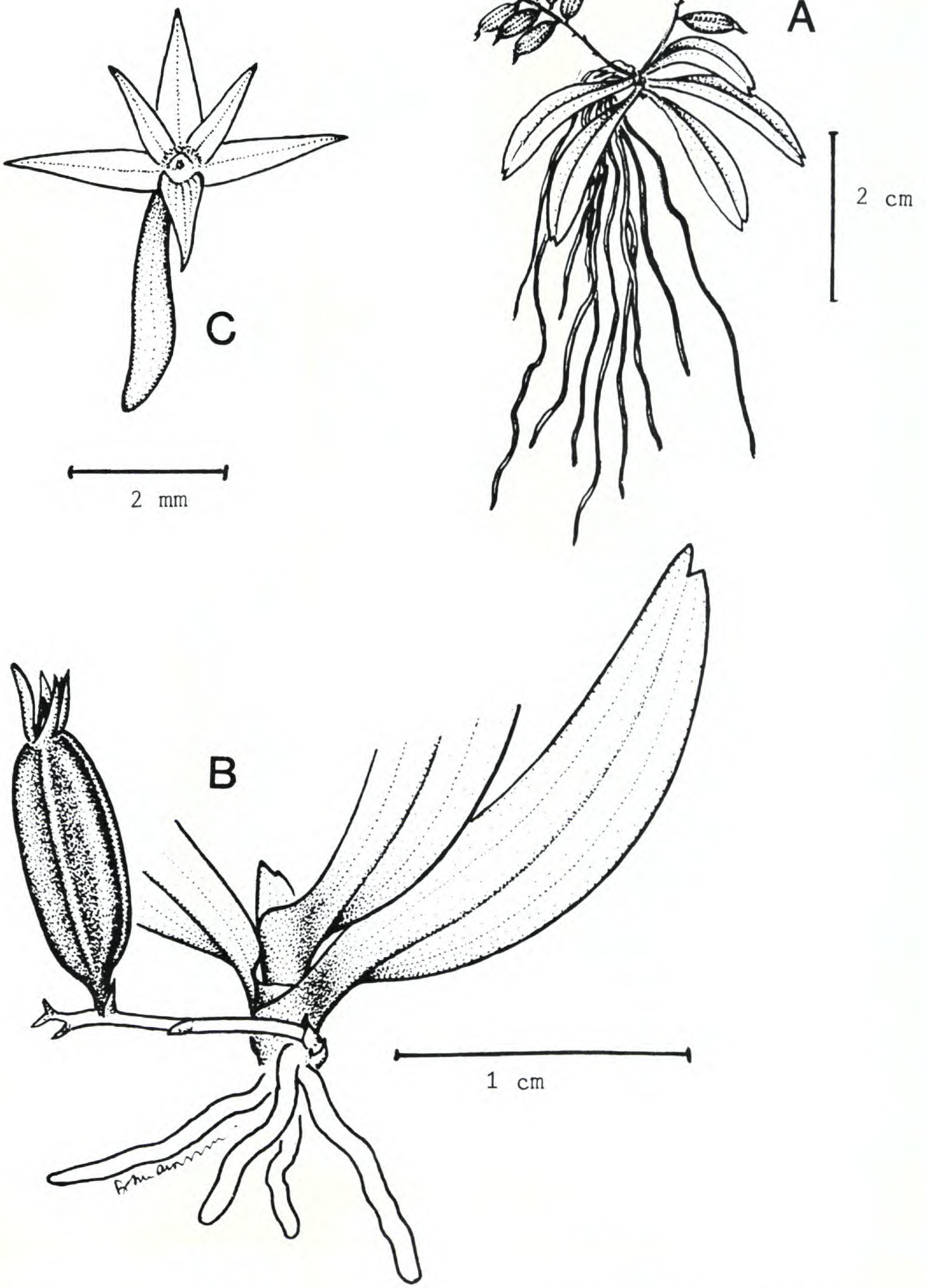


Figure 1. *Campylocentrum hondurense.* —A. Fruiting plant. —B. Detail of habit. —C. Flower, frontal view (based on *Ramírez & Laskowski 246*).

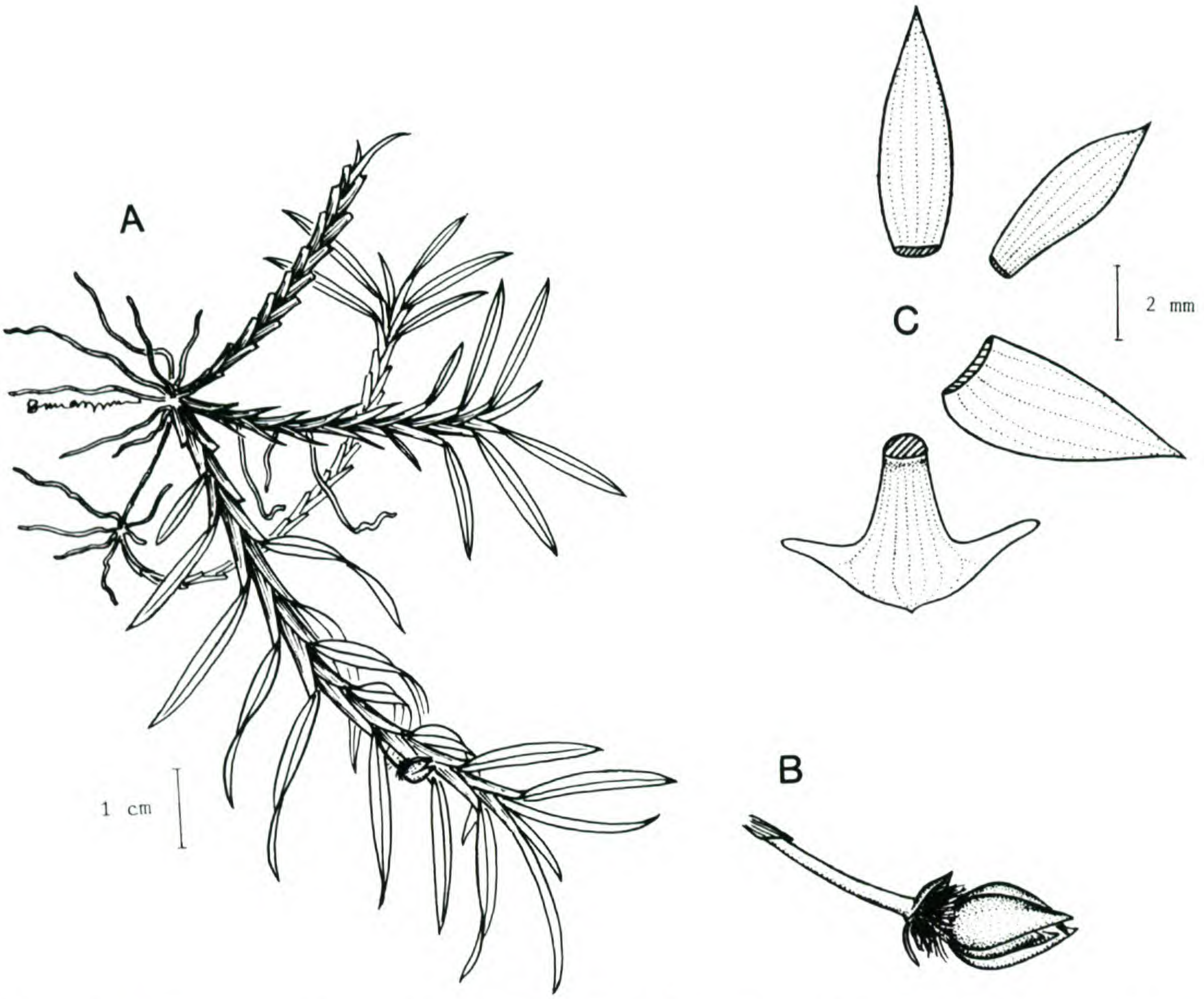


Figure 2. *Dichaea venezuelensis.* —A. Flowering habit. —B. Lateral view of flower with developing capsule. —C. Perianth segments, flattened (based on *Carnevali & Ramírez 2030*).

Epiphytic herbs, small to medium sized, suberect to pendulous. Stems 7–15 cm long, 3–4 mm thick, usually simple, if branching, then only near base, laterally compressed. Leaves 25–31 mm long, 3–4 mm wide, articulate with sheaths, linear-oblong or linear-elliptic, acute, aristate-acuminate, margins apically minutely ciliolate. Inflorescences uniflorous, solitary in leaf axils; peduncle filiform, terete, 7–10 mm long, with two basal sheaths 3 mm long, 2.5 mm wide; the sheaths imbricate, oblong-elliptic, acute dorsally carinate. Floral bract 2.8–3.1 mm long, ca. 2 mm wide, broadly ovate, acuminate, dorsally carinate. Bracteole 2.8–3 mm long, 0.3 mm wide, linear, acuminate. Ovary 0.8–1 mm long, densely muricate with white hairs (when living). Flowers small, not opening widely and frequently cleistogamous, with greenish white, basally red-speckled sepals and petals; labellum white; column green with red margins. Sepals and petals fleshy, 5-nerved. Dorsal sepal 4.5–5.2 mm long, 2.2–2.4 mm wide, ovate-elliptic, acute. Lateral sepals 5.3–6.2 mm long, 2.4–2.8 mm wide, obliquely ovate-elliptic, acuminate. Petals 4.1–4.5 mm long, 1.9–2.1 mm wide, oblong-elliptic to oblong, acute and apiculate or shortly acuminate. Labellum 4–4.2 mm long, fleshier than other perianth segments, very broadly obovate, anchorlike from a broadly cuneate-unguiculate claw, the claw 2.5–2.7 mm long, the blade 5–5.5 mm wide between the apices of the extended lateral lobes, dilated into an abruptly crescentiform anterior portion, apically very broadly rounded or subtruncate, shortly and obtusely apiculate in the center, the apical lateral lobes retrorse, 1.5–2 mm long. Column 1.5 mm long on dorsal face, 2.8–3 mm long on ventral face, ca. 1.5 mm thick, with a pubescent, triangular infrastigmatic ligule 0.5 mm wide.

Paratypes. VENEZUELA. **Bolívar:** 78 km S de Urimán-tepui, bosques en alrededores de pequeña cima de arenisca, 04°39′N, 62°36′W, 450 m, Sep. 1986, *Fernández 3424* (MYF, VEN); Gran Sabana, Amarway-tepui, 600–900 m, floración en cultivo de una planta

originalmente colectada por R. Liesner & B. Holst, 30 Sep. 1986, *Carnevali & Ramírez 2030* (VEN); cercanías de Wonkén, Río Akaruai, vegetación riparina, 800–900 m, 11 Sep. 1983, *Morillo et al. 9445* (VEN). **Miranda:** Parque Nacional Guatopo, bosque nublado, 600–800 m, 10°03′N, 66°27′W, 27 May 1987, *Capote 140* (VEN). **Táchira:** ca. 35 km SSE de San Cristóbal, La Buenana, 6–12 km from Quebrada Colorado, primary forests, 600–1,000 m, 07°28′N, 72°09′W, 20–21 Mar. 1981, *Liesner & González 10848* (MO, VEN). **Territorio Federal Amazonas:** Río Ararí, afluente del Matapire, 3–6 km aguas arriba de la desembocadura del primero, 530–550 m, 01°30′N, 65°13′W, 14 Nov. 1982, *Guánchez 2250* (TFAV, VEN).

This new *Dichaea* is one of about 15 species in the genus with articulated leaves and echinate ovaries. It appears to be related to the Ecuadorean *D. riopalenquensis*, which has larger flowers and a differently proportioned labellum. Another related species is *D. cleistogama* Dodson, also from Ecuador, with which it shares the tendency toward cleistogamous flowers, but *D. venezuelensis* is different in its narrower leaves and perianth segments. Specimens of *D. venezuelensis* have previously been confused with *D. brachypoda* Reichenbach. f., a similar but larger species. In *D. brachypoda* the perianth segments are brownish violet within and are 7.5–8.5 mm long. *Dichaea venezuelensis* grows as an epiphyte at altitudes of 450–1,000 m, in wet forests. It is a widespread, though uncommon species in Venezuela.

SUBTRIBE GASTRODIINAE

Uleiorchis liesneri Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Departamento Atures, lower forested E slope of unnamed 1,760 m peak, 8 km NW of Yutajé, 1,050–1,200 m, 5°41′N, 66°9′W, 13 Mar. 1987, *Liesner & Holst 21893* (holotype, VEN; isotype, MO). Figure 3.

Species haec *Uleiorchis ulaei* (Cogniaux) Handro affinis sed differt labello longiore, proportione angustiore, 15–16 mm longo, 3–3.2 mm lato vs. 11 mm longo, 4.5 mm lato, i.e., 5-plo longiore quam latiore (vs. 3-plo longiore quam latiore), anguste oblongo-elliptico (vs. ovato-elliptico), longiore vel subaequante quam copa perianthina (vs. breviore quam copa perianthina).

Saprophytic, erect herbs, 15–33 cm high, shade-loving. Basal corms 3–10 mm thick, horizontal, fusiform. Stems 1–2 mm thick, terete, straight or arched, simple or bifurcate, mostly naked except for membranous sheaths at nodes; sheaths 4–5 mm long, 3 mm wide, ovate, acute to subacuminate, 5–6-nerved. Flowers solitary at stem apex, resupinate, horizontal, not widely opening. Floral bracts 5–6 mm long, 3–4 mm wide, similar to cauline sheaths, loosely fitting the pedicellate ovary. Pedicellate ovary obconic, subtrigonous; pedicel 3–4 mm long, terete, ovary 4–4.5 mm long. Sepals and petals fused into a cup or sac longitudinally opened at the ventral face, this opening entirely filled in natural position by the labellum. Perianth cup dorsally 14–16 mm long, 17–18 mm long ventrally from base of columnar foot, 5–6 mm wide, subtriangular in lateral view; free portions of sepals and petals 0.5–1.5 mm long, triangular elliptic, acute, obtuse or truncate, the sepaline tails somewhat longer; expanded perianth cup 13–15 mm wide at base. Labellum 15–16 mm long, 3–3.2 mm wide, simple, narrowly oblong-elliptic, apically subrounded or broadly obtuse, basally subrounded-truncate with a claw 1 mm long by which the blade is hinged to column-foot; blade concave, margins undulate-crenate, ventral face laterally finely and densely black-verruculose, with an intense grayish hue, medially smooth and cream-colored. Column 8–10 mm long; basal zone subcylindric, 4–4.5 mm long; apical, stigmatic zone 4.5–5 mm long, obovate, truncate, pubescent; column-foot 4.5–5.5 mm long, forming an angle of ca. 60° with the ovary; rostellum 2 mm long, flat, horizontal. Capsules obovoid, 10–12 mm long with pedicel up to 12 mm long.

This is the second known species in this saprophytic genus. It differs from *U. ulaei* by its solitary flower and longer and narrower labellum, which is longer or nearly equal in length to the perianth cup. *Uleiorchis liesneri* seems to inhabit altitudes above 1,000 m, while *U. ulaei* is only known from below 500 m. The species is named after Ronald Liesner of the Missouri Botanical Garden, one of the most important plant collectors in the Venezuelan Guayana.

KEY TO THE SPECIES OF *ULEIORCHIS*

1a. Labellum narrowly oblong-elliptic, 5 times or more as long as wide, 15–16 mm long, longer than or subequaling the perianth cup .. *U. liesneri*
1b. Labellum ovate-elliptic or ovate, 2.5–3 times as long as wide, up to 11 mm long, shorter than the perianth cup ..... *U. ulaei*

Notes on *Uleiorchis ulaei*

Uleiorchis ulaei was previously known from southeastern and Amazonian Brazil and southern Venezuela, but it is now known to occur in Panama and Peru as well. In Venezuela, it has recently been collected in the northwestern state of Zulia, in the foothills of the Sierra de Perijá. Perijá is known to have floristic relationships both with the Amazonian Basin (Steyermark, 1982), as shown by such orchids as *Epidendrum huebneri* Schlechter and *E. smaragdinum* Lindley, and with the Atlantic Coast of

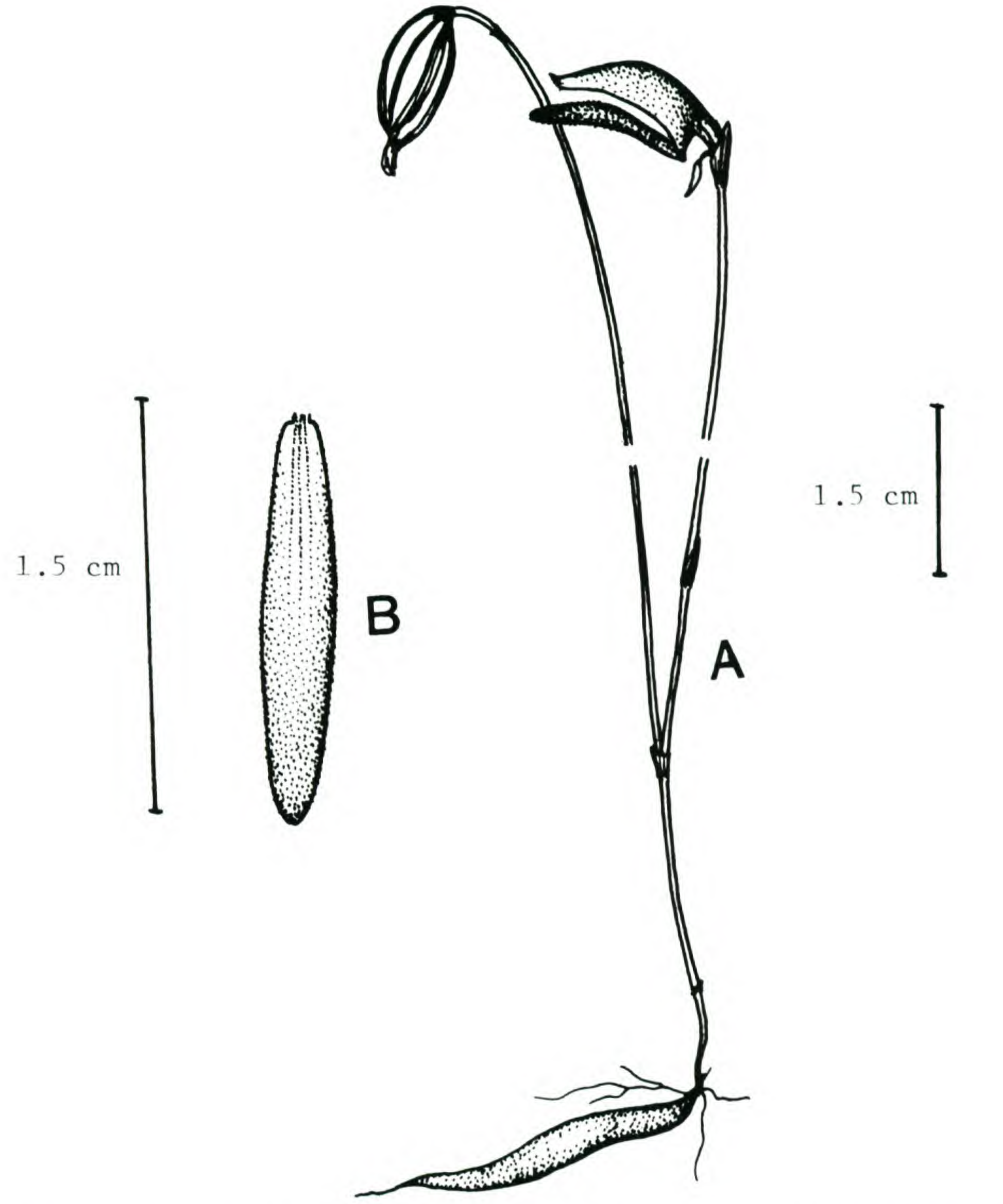


Figure 3. *Uleiorchis liesneri.* —A. Flowering plant. —B. Labellum, flattened (based on *Liesner & Holst 21893*).

Panama and Central America, as shown by such orchids as *Leucohyle subulata* (Swartz) Schlechter, *Trigonidium egertonianum* Bateman, *Trichocentrum capistratum* Reichenbach f., and *Encyclia hunteriana* Schlechter.

Specimens examined. PANAMA. **Canal Zone:** Military reserve Fort Sherman, between Gatún and Piña, 0–170 m, 2 Apr. 1973, *Liesner 1367* (MO). **San Blas:** El Llano–Carti Road km 26.5, 9°19′N, 78°55′W, 200 m, 8 Apr. 1985, *de Nevers et al. 5248* (MO). PERU. **Pachitea:** Puerto Inca, 250–300 m, 09°18′S, 74°58′W, 15 Sep. 1982, *Foster 8825* (MO). VENEZUELA. **Bolívar:** Sierra Maigualida, 300–500 m, 26 Apr. 1966, 6°N, 65°W, *Steyermark 95775* (VEN). **Zulia:** 55 km SW of Machiques by air, Aricuaisá, 100–250 m, 9°36′N, 72°5′W, 24–25 Mar. 1982, *Liesner & González 13177* (VEN). **Territorio Federal Amazonas:** Cerro de La Neblina, 150–500 m, 0°50′N, 66°10′W, 20 Feb. 1984, *Liesner 15934-a* (MO, VEN), 20 Feb. 1984, *Liesner 16129* (MO, VEN).

SUBTRIBE MAXILLARIINAE

Maxillaria ×dunstervillei Carnevali & I. Ramírez, nothosp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Cerro de la Neblina, Camp II, 2.5–3.5 km of Pico Phelps, wet meadow with *Heliamphora*, grasses and sphagnum surrounded by low forest of predominantly *Euterpe* and *Bonettia*, "Flowers yellow, growing

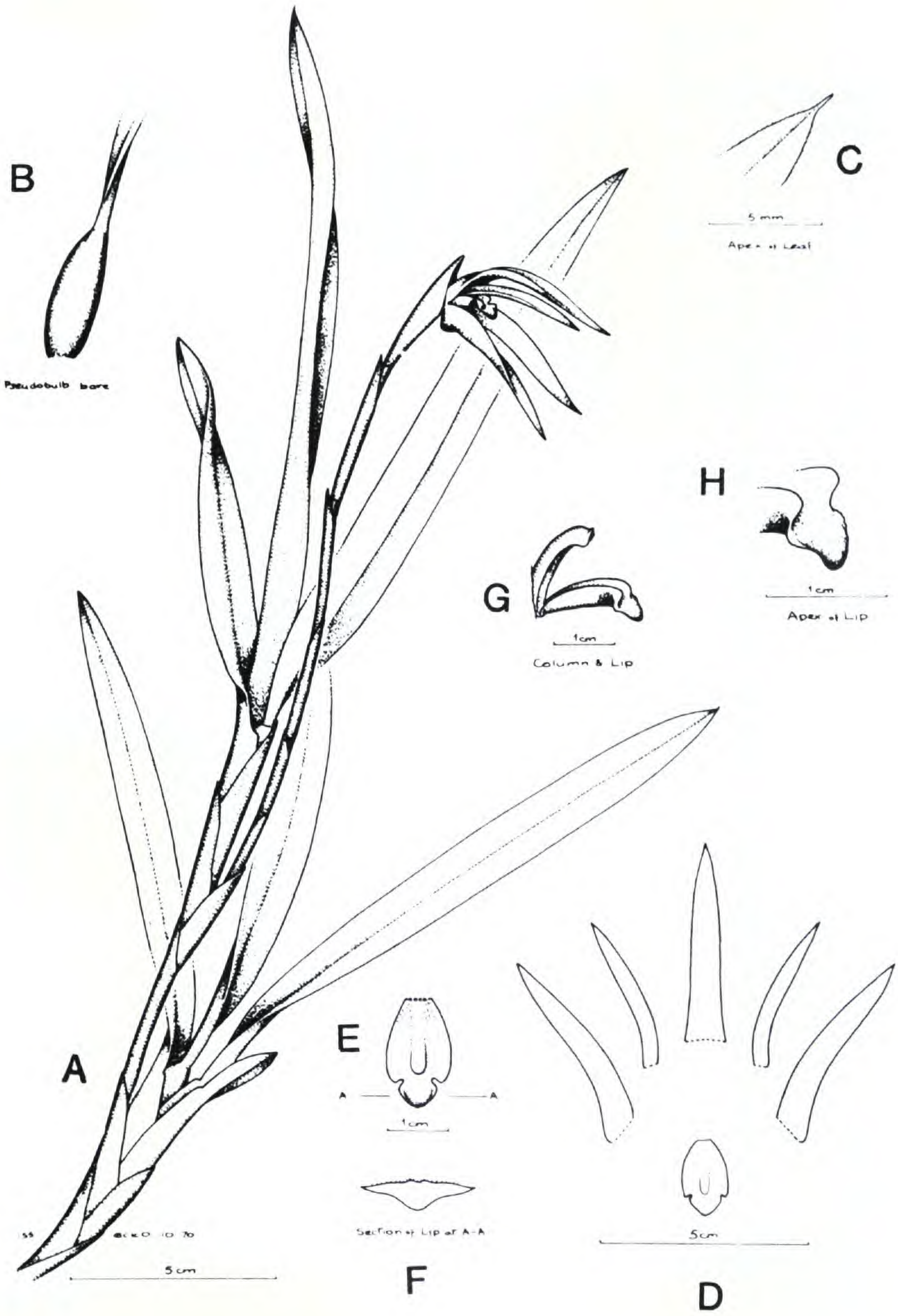


Figure 4. *Maxillaria* ×*dunstervillei.* —A. Flowering habit. —B. Pseudobulb, bare. —C. Apex of leaf. —D. Perianth segments flattened. —E. Detail of flattened labellum. —F. Transversal section through midlobe of labellum. —G. Labellum and column, other perianth segments removed. —H. Apex of labellum in natural position (based on *Dunsterville 1155;* illustration by G. C. K. Dunsterville, courtesy of AMES).

on tree in moss," 0°50′N, 65°48′W, 2,000 m, 17–22 Feb. 1984, *Funk 6258* (holotype, VEN; isotype, US). Figure 4.

Planta et flos inter *Maxillariam meridensem* Lindley et *M. quelchii* Rolfe quasi intermedia, vel variabilis. A *Maxillaria quelchii* similis sed rhizomatis vaginis scabriusculis longioribus; foliis pseudobulbisque angustioribus, sepalis petalisque longioribus, flaveobrunnescentibus concoloribus vel parum bicoloribus, labelli lobulo centrali ovato, subacuto vel rotundato, parum verruculoso, callo elongatiore differt.

This natural hybrid was first noted by Dunsterville (1972) but he failed to provide a Latin diagnosis, probably because he was not sure of its identity. Material collected in the same general area indicates that these plants probably represent the product of introgression between *Maxillaria meridensis* and *M. quelchii.* Several lines of evidence point to the hybrid origin of these populations restricted to the highlands of the Neblina Range in southern Venezuela and northern Brazil. First, these plants show

intermediate stages between the putative parents in most morphological characters. Second, the distribution of the character states is by no means even, some plants being almost exactly intermediate, others closer to one parent, others to the alternative parent. As Hurst (1902) pointed out, "in orchid hybrids of the first generation single specific characters are inherited in all degrees of blending, forming as a whole, a perfect series between the respective characters of the two parents." Third, these plants grow in mixed populations with both parents, being apparently (based on abundant collections of this complex in the area) rarer than any of them. Fourth, *Maxillaria meridensis* and *M. quelchii* are the only *Camaridium*-like species in the genus present at such high elevations in the area where these natural hybrids occur. The only other species of the *Camaridium* group to be found in the Neblina Range, but usually at lower altitudes, is *M. mapiriensis* (Kränzlin) L. 0. Williams, which has different pollinaria, much smaller flowers and leaves, and is unlikely to have the same pollinator as the two putative parents.

Maxillaria meridensis is characterized by long rhizomes with small (1.5–3.5 cm long, 1–1.5 cm wide), narrowly fusiform pseudobulbs set distantly apart. Both pseudobulbs and rhizome are concealed by scabrous-pustulose sheaths. Leaves are linear to linear-lanceolate, 9–28 cm long, 1–1.5 cm wide and acute. The perianth segments are yellowish or yellow-brown to dull orange, with sepals 17–22 mm long. The apical lobe of the labellum is very fleshy and ovate to triangular-ovate, and its surface is smooth to lightly scabrous. *Maxillaria quelchii*, on the other hand, has a more compact growth habit with pseudobulbs closely set on the rhizome, although it can be definitely creeping; the pseudobulbs and rhizome are concealed by striate sheaths. The pseudobulbs are 2.5–3 cm long, 1.5–2 cm wide. Leaves are oblong-lanceolate to oblong-oblanceolate and obtuse to broadly acute. The perianth segments are white or yellowish basally, grading abruptly to a very dark maroon that is shiny in the outer surface; sepals are 31–37 mm long. The apical lobe of the labellum is transversely elliptic to obovate-suborbicular and coarsely verruculose. Depending on the individual, *Maxillaria* ×*dunstervillei* shows variable combinations of all these character states. In all the plants collected, the abrupt change in color that occurs in the sepals and petals of *M. quelchii* has been obliterated or somewhat "washed out" due to the influence of *M. meridensis*. The holotype is a plant closer to *M. quelchii*, but with narrower leaves and pseudobulbs and an almost smooth central lobe approaching *M. meridensis;* the sepals in these specimens are up to 48 mm long, apparently showing some degree of hybrid vigor. A paratype (*Stein & Gentry 1571*) is much closer to *M. meridensis* vegetatively, but the flowers are large and similar to those of *M. quelchii*. The other two paratypes (*Dunsterville 1154, 1155*) are more intermediate between the putative parents. The pollinaria of the hybrids are intermediate among those of the putative parents. All the collections made of this hybrid come from a small area in the Neblina Range, although both putative parents are rather common and widespread in all the Guayana Highlands.

Maxillaria schlechteri Foldats (syn. *M. rugosa* Schlechter), described from Roraima, may represent this hybrid, although the description suggests only a narrowly central-lobed form of *M. meridensis*. This taxon has never been collected again, and the type seems to have been destroyed in the bombardment of the Berlin herbarium during World War II.

Paratypes VENEZUELA. **Territorio Federal Amazonas:** Cerro La Neblina, Camp. II, 2.8 km NE of Pico Phelps, 2,100 m, 0°49′40″N, 65°59′W, open bog, 15 Apr. 1984, *Stein & Gentry 1571* (MO, VEN). BRAZIL. **Amazonas:** Cerro La Neblina, Pico Zuloaga, close to NE lateral cliff fall, 2,400 m, Oct. 1972, *Dunsterville 1154* (AMES, HB), *Dunsterville 1155* (AMES, HB).

Maxillaria foldatsiana Carnevali & I. Ramírez, Ann. Missouri Bot. Gard. 76: 376. 1989.

This is the first collection of this species for Guyana. It was previously known only from the type collection in southern Venezuela.

Specimen examined. GUYANA. **Mazaruni–Potaro:** Membaru Creek, upper Mazaruni River, 13 Feb. 1939, *Pinkus 209* (AMES).

Maxillaria grobyoides Garay & Dunsterville, Ven. Orch. Ill. 5: 186, 1972.

This taxon seems to be widespread, though rare or only locally common in the northern Amazon Basin. The following are the first collections reported for Colombia and Peru. It was previously known from Brazil and Venezuela.

Specimens examined. COLOMBIA. **Vaupés:** Río Aparoris, Raudal del Jirijirimo, 7 ago. 1951, *Schultes & Cabrera 13439* (AMES). PERU. **Loreto:** Alto Amazonas, carretera Oleoducto secundario entre Andoas y Capahuari Sur, 2°50′S, 76°28′W, 210 m, 13 Sep. 1979, *Díaz & Jaramillo 1374* (MO).

Maxillaria maleolens Schlechter., Feddes Rep. Sp. Nov. Beih. 19: 233. 1923.

Maxillaria maleolens is closely related to *M. violaceopunctata* Reichenbach f. from the Guianas

and the Amazon Basin, from which it differs mainly by details of labellum shape and coloration, by its broader sepals, and by its fragrance, which despite the specific epithet is not disagreeable. This species is apparently widespread but uncommon in Mexico, Belize, Costa Rica, and Panama. It is now recognized from Colombia, close to the Panamanian border.

Specimen examined. COLOMBIA. **Chocó:** Bahia Solano, 0–100 m, 25 July 1973, *Warner & White 37* (MO).

Maxillaria nuriensis Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Bolívar: Altiplanicie de Nuria, cloud forest on summit of SE-facing escarpment, E of Cerro El Picacho, N of Las Nieves and Las Chicharras, 45 km N of Tumeremo, vicinity of Deborah, 600–650 m, 5–8 Feb. 1967, *Steyermark 89128* (holotype, VEN; isotype, NY). Figure 5.

(Species) *Maxillariae melinae* Lindley similis sed labello cuarto apicali trilobato, petalis angustioribus recedit.

Epiphytic herbs, medium sized, caespitose, erect. Pseudobulbs 2.5–3 cm long, 1–1.3 cm wide when dry, obliquely oblong, apically unifoliate, clothed by 2–4 sheaths, the innermost 1–2 bearing leaves. Leaves 9.5–25 cm long, 2.1–3 cm wide, the blades submembranous, oblong-elliptic, acuminate, basally attenuate into a pseudopetiole 4–6.5 cm long, ca. 2 mm thick, 2–3 times longer in the apical leaf. Inflorescences 5–8 cm long, uniflorous, much longer than pseudobulb but shorter than leaves (nearly equaling petioles), entirely clothed by tubular, scarious, subimbricate sheaths. Flowers medium sized for the genus, resupinate, with subparallel, creamy-colored perianth segments. Pedicellate ovary 2.3–2.8 cm long, subterete. Floral bract 1.8 cm long, 0.7 cm wide, elliptic, acute. Perianth segments submembranous, strongly nerved in rehydrated material. Dorsal sepal 2–2.2 cm long, 0.5–0.6 cm wide, narrowly triangular to triangular, acuminate, 9-nerved. Lateral sepals 2.2 cm long, ca. 0.5 cm wide, similar to dorsal but somewhat oblique. Petals 1.6–1.8 cm long, 0.3–0.32 cm wide, narrowly triangular-oblong, acuminate, 7–8-nerved. Labellum 1.5–1.7 cm long, about 0.5 cm wide, narrowly elliptic-obovate, slightly 3-lobed above apical fourth, the lateral margins erect in natural position; lateral lobes small, subtruncate to rounded; central lobe 4 mm long, 2.7 mm wide, fleshy, ovate, obtuse to subacute, somewhat verruculose; disk with an oblong, acute callus slightly above middle of blade of labellum. Column ca. 8 mm long, apically 3 mm thick, hemicylindric, somewhat laterally flattened, basally produced into a 5-mm-long, almost perpendicular foot.

This new species is related to the *Maxillaria melina* Lindley complex. Among the species of this group it can be recognized by the following character combination: labellum 3-lobed above apical ¼; columnar foot 6 mm long, slightly shorter than column (8 mm long), sepals 2–2.2 cm long, and narrow petals (1.6–1.3 cm long, 0.3–0.32 cm wide). *Maxillaria nuriensis* can be readily distinguished from the closely related *M. melina* by its apically 3-lobed (not pandurate) labellum and its narrower petals.

Maxillaria santanae Carnevali & I. Ramírez, Ann. Missouri Bot. Gard. 76: 377. 1989.

The following collection is the first of this species for Guyana. All known localities in Venezuela and Guyana are very close to the borders of Brazil, so it is expected that this species will be found there also. It is also known from Ecuador.

Specimen examined. GUYANA–BRAZIL BORDER. Akarai Mountains, between Rio Mapuera (Trombetas tributary) and Shodikar Creek (Essequibo tributary), 600–800 m, 19 Jan. 1938, *Smith 2987* (AMES, NY).

Maxillaria tenuis C. Schweinfurth, Bot. Mus. Leafl. 11: 289, t. 18. 1945.

The study of previously undetermined material allows us to report the first collections from Colombia of this typically Amazonian species. It was previously known from Venezuela, Brazil, and Peru.

Specimens examined. COLOMBIA. **Vaupés:** Río Kanarari, Cerro Isibukuri, 250–700 m, 4 Aug. 1951, *Schultes & Cabrera 13371* (AMES); Río Kuduyari, 300 m, 23–25 June 1958, *Garcia-Barriga et al. 15775* (AMES, MO).

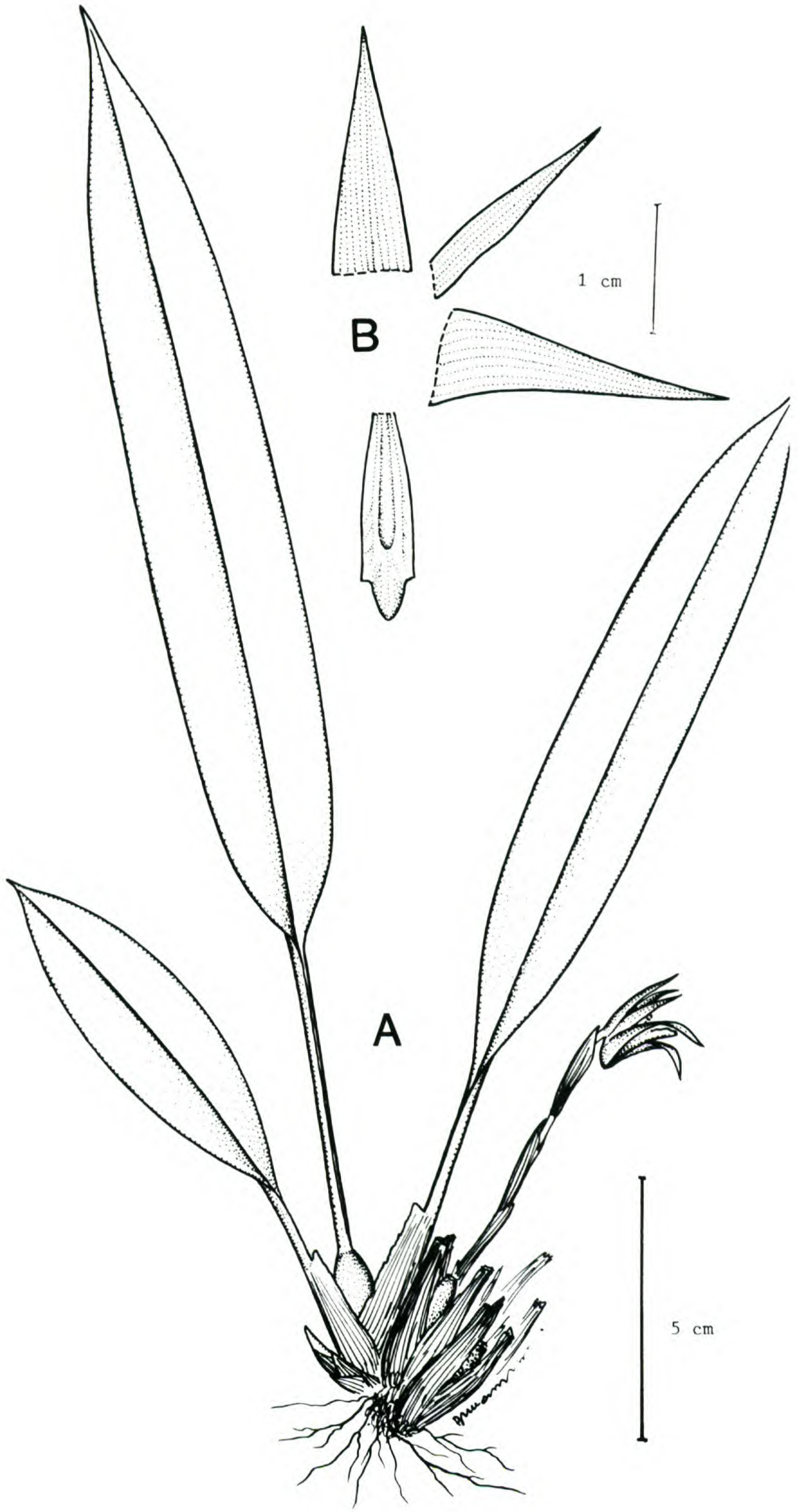
SUBTRIBE ORNITHOCEPHALINAE

Caluera Dodson & Determann

Caluera surinamensis Dodson & Determann, Amer. Orchid Soc. Bull. 52: 377. 1983.

Material belonging to this species was collected more than 20 years ago in Venezuela, but remained unidentified until now. Besides the herbarium specimen mentioned here, the authors have seen living material collected in Parque Nacional Guatopo, Estado Miranda and cultivated by Halina Mendez, in Caracas, Venezuela. This is the first record of the genus *Caluera* for Venezuela. This species is also known from Surinam and French Guiana.

Specimen examined. VENEZUELA. **Barinas:** Reserva Forestal Caparo, bosque tropófilo, Unidad I, parte S de la pica 7 y 9, 16–18 km SE del Campamento Cachicamo, E de El Cantón, 100 m, 9 abr. 1968, *Steyermark et al. 101989* (MY, VEN).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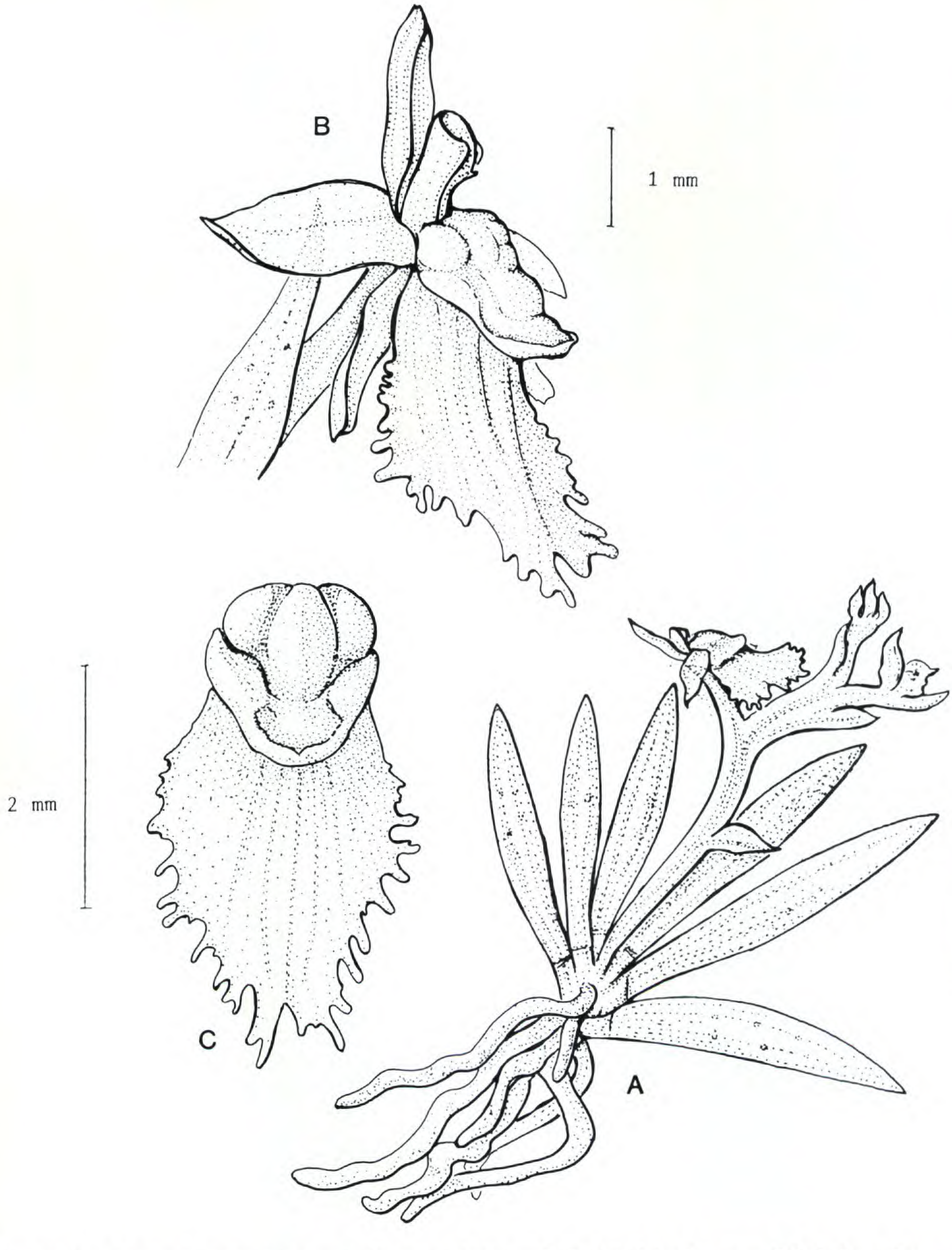

Figure 6. *Eloyella panamensis*. —A. Flowering habit. —B. Detail of the flower. —C. Labellum, flattened (illustration by J. Myers, based on *Stergios & Taphorn 13416*).

Eloyella Ortiz

Eloyella panamensis (Dressler) Dodson, Icon. Plant. Trop., ser. 2: pl. 0455. 1989. Figure 6.

This diminutive twig-epiphyte was recently collected for the first time in Venezuela, growing in a high tree at 15–20 m in riparine forests. This is the first record of the genus *Eloyella* for Venezuela.

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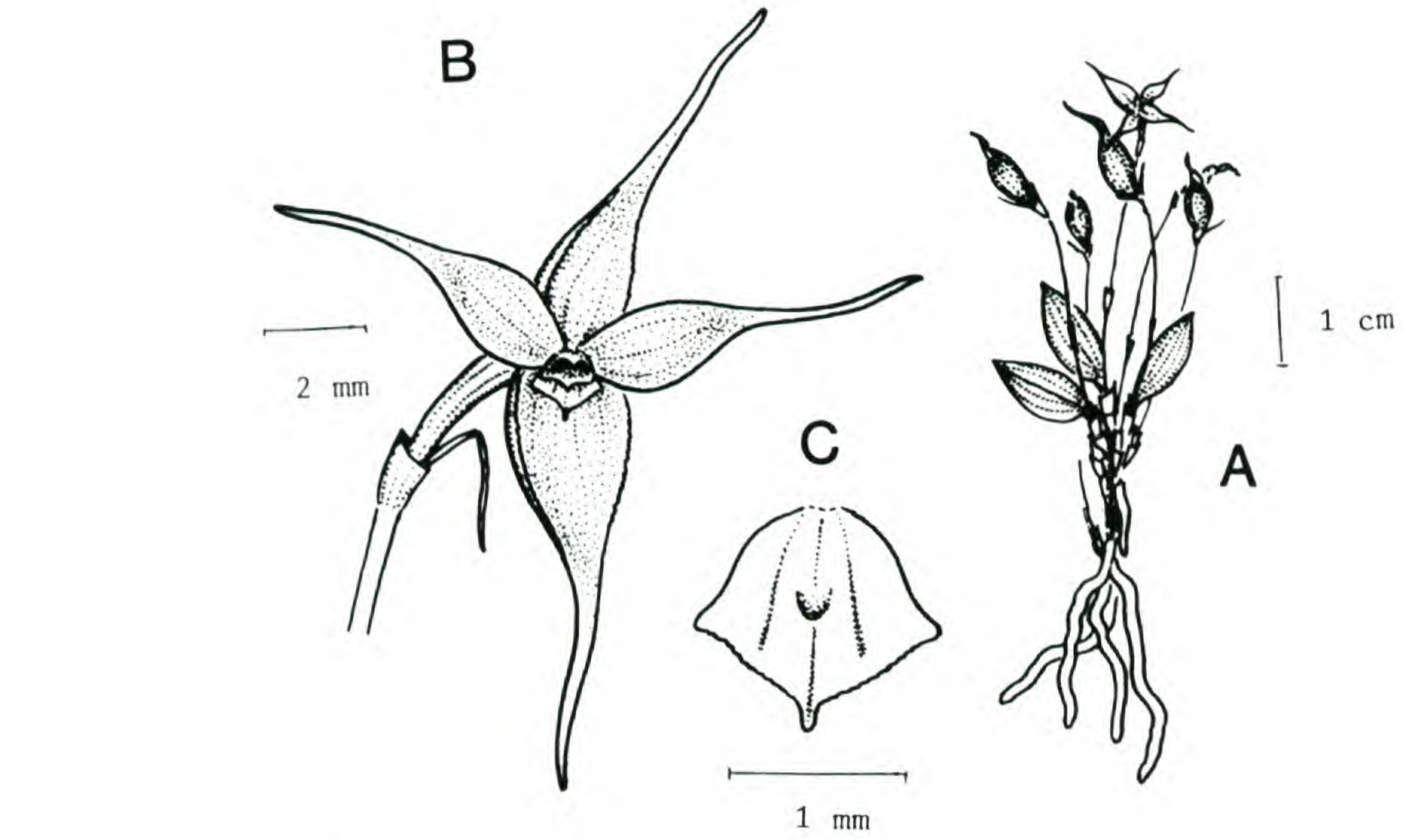
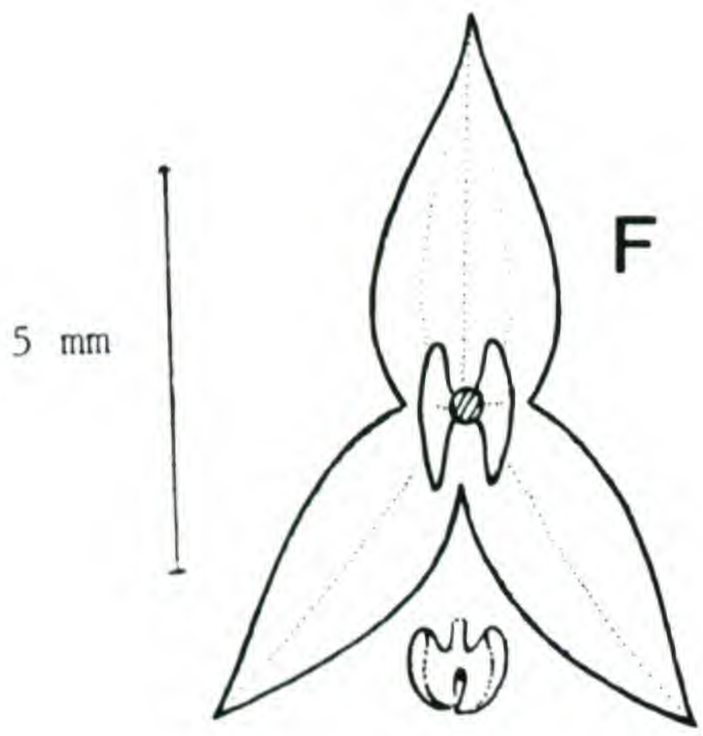
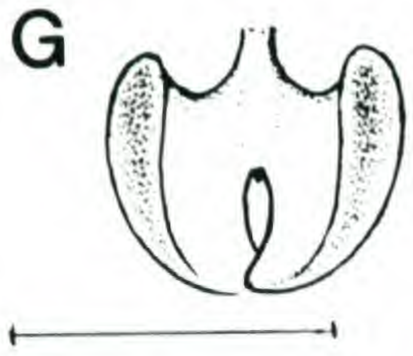
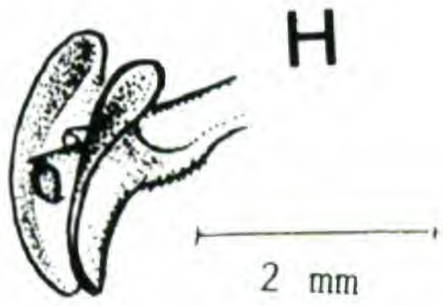
Figure 5. *Maxillaria nuriensis*. —A. Flowering habit. —B. Perianth segments, flattened (based on *Steyermark 89128*).









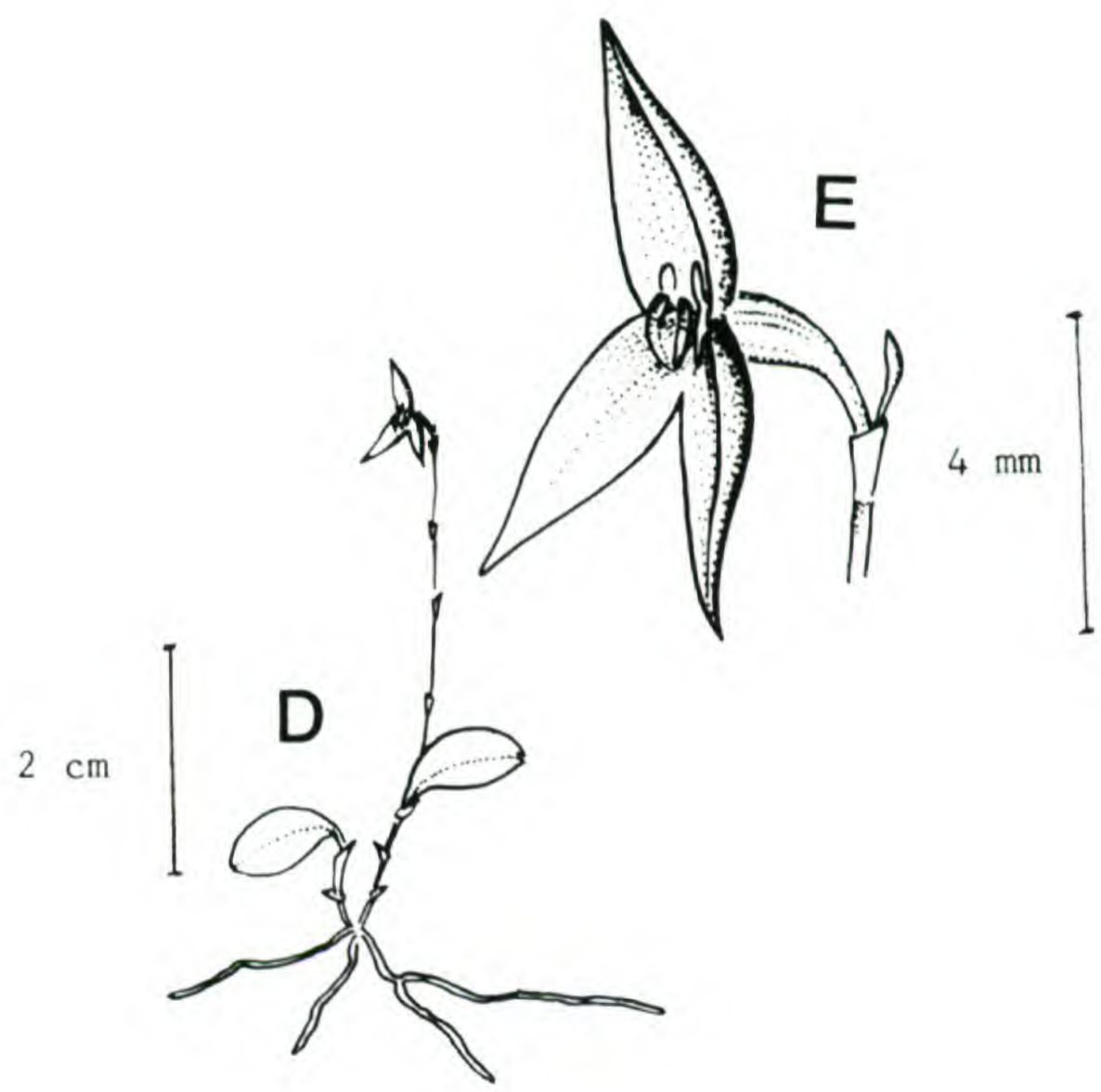


Figure 7. A–C. *Brachionidium parvum.* —A. Flowering plant. —B. Flower. —C. Labellum (based on *Liesner & Holst 21724*). D–H. *Lepanthes unitrinervis.* —D. Flowering plant. —E. Flower. —F. Perianth segments flattened. —G. Labellum. —H. Lateral view of labellum and column (based on *Liesner 23433*).

Eloyella panamensis was previously known from Panama and Ecuador.

Specimen examined. VENEZUELA. **Bolívar:** Distrito Sucre, Caño Icutú, Río Nichare, afluente del Río Caura, 5°53′N, 69°51′W, 150–200 m, 24 mar. 1989, *Stergios & Taphorn 13416* (PORT, VEN).

SUBTRIBE PLEUROTHALLIDINAE

Brachionidium Lindley

Brachionidium parvum Cogniaux, Repert. Spec. Nov. Regni Veg. 6: 307, 1909. Figure 7A–C.

This species was previously known only from Grenada, Dominica, and Haiti, but recently it has been collected several times in the Venezuelan Guayana. It had been erroneously included in the Venezuelan Flora by Garay (1956) when he reduced *B. longicaudatum* Ames & C. Schweinfurth to its synonymy. This latter taxon is clearly a different, much larger species that grows at higher elevations on tepui summits. Foldats (1970a), in his treatment of the genus, followed Garay's interpretation of *B. parvum*, and the description he provided was a mixture of *B. parvum* and *B. longicaudatum*. Here we offer the first complete description based on all the material available of *B. parvum*. Data on populations from the West Indies were kindly provided by C. A. Luer.

Epiphytic or subterrestrial, humicolous, erect herbs, 4–8 cm high including inflorescences. Roots few, thick, relatively short. Rhizome to 12 mm long, erect, subterete, concealed by scarious sheaths. Ramicauls 3–4 mm long and ca. 1 mm diam., spaced 1–4 mm on the rhizome, subterete to subtrigonous, concealed by two sheaths, these 2–3 mm long, inflated, costate, mucronate. Leaves 8–16 mm long, 4–5.5 mm wide, 7-nerved, fleshy, erect to suberect, elliptic, acute with a 3-denticulate apex, basally attenuate into a pseudopetiole 1–3 mm long. Inflorescences from the ramicaul apex, solitary, uniflorous, erect; peduncle 12–22 mm long, subterete, straight, with a median, long-mucronate sheath 2–3.5 mm long, tubulose, inflated, subcostate. Floral bract similar to peduncle sheath, 2–2.5 mm long. Pedicel 0.5–1.5 mm long, laterally compressed. Filament 2.5–4 mm long, filiform, thickened toward apex. Ovary 2–2.5 mm long, subtrigonous. Flowers greenish to hyaline, nonresupinate, often fertilized. Dorsal sepal 5–7.5 mm long, 3-nerved, blade 4.5 mm long, 2.5 mm wide, ovate, acute, caudate, the margins finely ciliate, tail 1.5–3.5 mm long; lateral sepals connate into a 4-nerved synsepal, dimensions as for dorsal sepal, tail minutely bifid. Petals 5–7.5 mm long, 3-nerved, elliptic to oblong-elliptic, acuminate, blade 3.5–5 mm long, 1.5–2 mm wide, the tail 1.5–2.5 mm long, the margins finely ciliate. Labellum 1.2–1.5 mm long, 1.5–1.75 mm wide, fleshier than other perianth segments, transversely rhombic or subtrapeziform, apically rounded or obtuse and with a triangular apiculum 0.4 mm long, basally cuneate, the anterior margin erose; disk finely papillose, apically concave, basally with an ovoid, cushionlike, microscopically pubescent callus. Column 0.5–0.7 mm long, ca. 1 mm broad. Pollinia 6. Capsule 8 mm long, 3–4 mm diam., oblong-ellipsoid.

Specimens examined. VENEZUELA. **Bolívar:** 17 km E of El Paují, Río Las Ahallas, 850 m, 4°30′N, 61°30′W, 1 Nov. 1985, *Liesner 19270* (MO, VEN). **Territorio Federal Amazonas:** Departamento Atures, along stream on plateau N of unnamed 1,760-m peak, 9 km NW of settlement of Yutajé, 4 km W of Río Corocoro, W of Serranía de Yutajé, forested area, 5°41′N, 66°10′W, 1,050–1,300 m, 7 Mar. 1987, *Liesner & Holst 21724* (AMES, MO, VEN); Departamento Río Negro, Cerro Tamacuari, Sierra Tapirapecó, 1°N, 65°W, 1,400 m, Feb. 1989, *Santana & Gutierrez 43* (VEN).

This small species is apparently restricted in Venezuela to relatively low elevations in the Guayana. It is known from three stations 500–700 km apart and probably occurs in intervening places. Among other *Brachionidium* species it can be recognized by the following character combination: plant small; rhizome short, erect; leaves elliptic; inflorescences much longer than the leaves; sepals and petals minutely ciliate, long-caudate, and labellum transversely rhombic with a triangular apiculum.

Lepanthes Sw.

This is a genus of perhaps 600 or more mainly Andean species (Luer, 1986). The Amazon Basin and the Guayana Highlands are surprisingly species-poor, with less than 20 known species. To date, we know of nine species of *Lepanthes* in all of the Venezuelan Guayana. Most of the species in this area are either endemic or show an interesting close relationship with the *Lepanthes* flora of the Southern Antilles. Two species of the Venezuelan Guayana have proved to be undescribed, and a third one has recently had its known range extended into Brazil.

Lepanthes marahuacensis Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Departamento Atabapo, Cerro Marahuaca, summit on SE corner, open rocky plateau and ravines, 3°37′N, 65°21′W, 2,700 m, 13–14 Oct. 1988, "at base of bluff. Fruit greenish brown," *Liesner 24798* (holotype, VEN; isotype, MO). Figure 8.

Lepanthi dussii Urban similis sed ramicaulibus proliferis, scandentibus; rachidibus laxioribus; sepalis lateralibus in quintam partem basalem tantum connatis; columna valde elongata discrepat.

Plants small, epiphytic near ground on shrubs or subhumicolous, scandent or erect to prostrate. Roots relatively thick, 1–2 originating from bases or apices of ramicauls. Ramicauls 14–35 mm long, relatively stout, straight or arcuate, prolific, concealed in 4–7 close-fitting, imbricate, lepanthiform sheaths with scabrous to microscopically pilose costae and ostia.

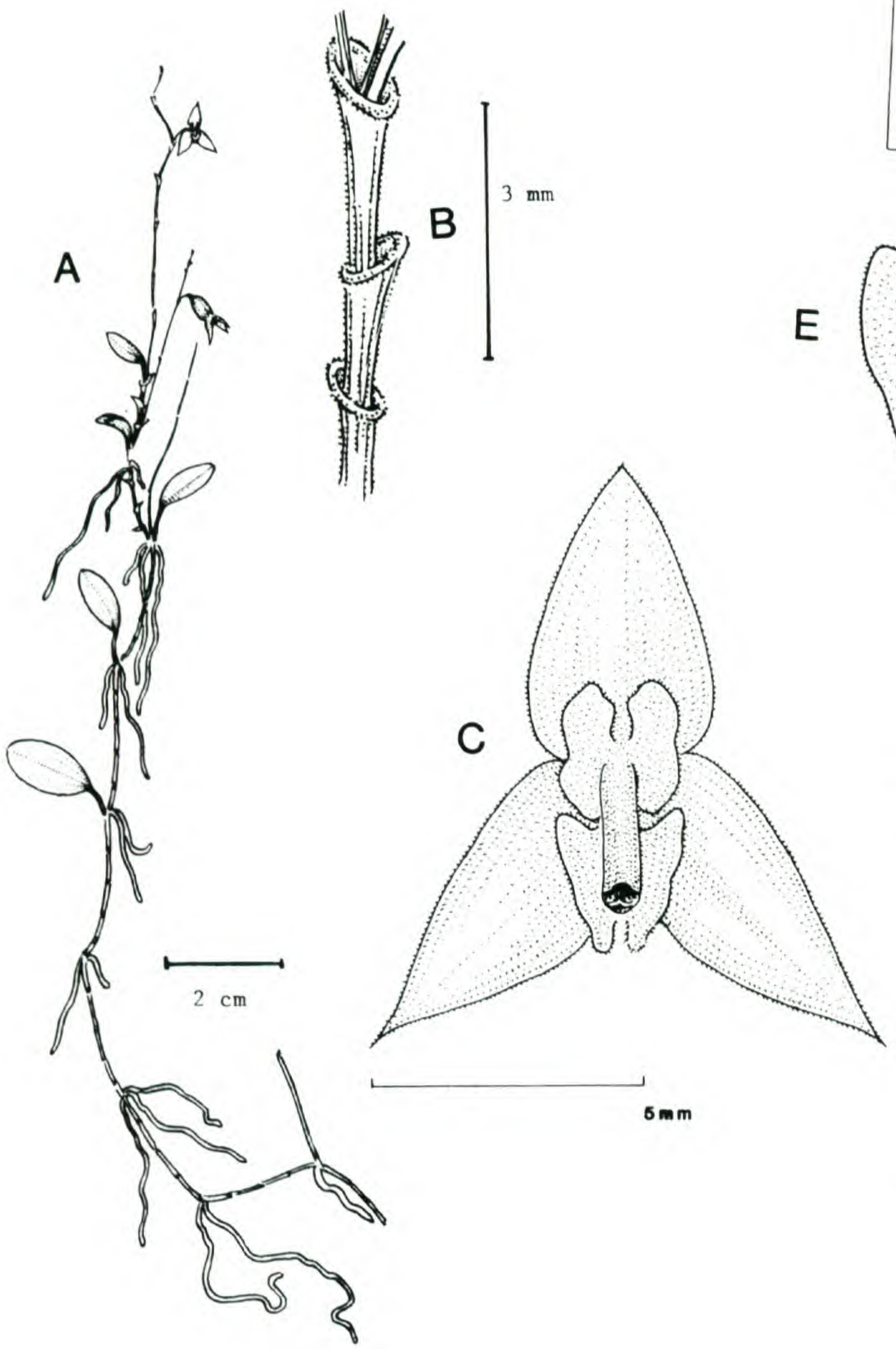


Figure 8. *Lepanthes marahuacensis*. —A. Flowering plant. —B. Detail of lepanthiform sheaths. —C. Flower, front view. —D. Petals. —E. Blades of labellum. —F. Column. —G. Lateral view of column, labellum, and petals (based on *Liesner 24798;* flowering plant by Bruno Manara, rest of the figure by Carlos Reynel).

Leaves 10–18 mm long, 5–8 mm wide, fleshy, perpendicular to ramicaul, 9-nerved, elliptic, obtuse to broadly obtuse at apex, subapically mucronulate, basally attenuate into a broadly channeled, 3-mm-long pseudopetiole. Inflorescences 2–4-flowered racemes, 30–60 mm long, 3–4 times as long as the subtending leaf, erect; peduncle 25–45 mm long, 4–8-articulate, terete, with bracts to 2.5 mm long, tubulose, much shorter than internodes, oblong-elliptic, abruptly acute, the margins scabrous; rachis to 20 mm long, lengthening with each successive flower, fractiflex, terete, the internodes 5–8 mm long. Floral bracts 1–2 mm long, similar to peduncle bracts. Pedicel 1.5–2.5 mm long, terete. Ovary 1.5–2 mm long, conspicuously ridged. Flowers, apparently nodding, hyaline to brownish purple. Sepals dorsally carinate, especially toward base, microscopically ciliolate within, glabrous without. Dorsal sepal 5 mm long, 3–3.5 mm wide, 3-nerved, ovate, acuminate; lateral sepals 5 mm long, 2.5–3 mm wide, 1-nerved, ovate-elliptic, acuminate, slightly oblique, connate in the basal fifth. Petals 0.6–0.8

mm long, ca. 2 mm wide, microscopically ciliolate on both sides, transversely elliptic-reniform; upper lobe 0.8–0.9 mm long, obtuse-rounded; lower lobe 1.1–1.2 mm long, obtuse. Labellum with the blades 2.2–2.5 mm long, ca. 1 mm wide toward the base, minutely pubescent, triangular-semilunate with obliquely acute upper end and acute-acuminate lower end; the blades overlapping at their lower ends when expanded; connectives and body dorsally pubescent, broadly cuneate, connate above basal third of the column; sinus acute; appendix very small, subtriangular, densely long pubescent. Column 2.5 mm long, elongate, cylindric, minutely pubescent. Anther dorsal. Stigma apical.

Paratype. VENEZUELA. **Territorio Federal Amazonas:** Departamento Atabapo, Cerro Marahuaca, type locality, 15 Oct. 1988, *Liesner 24828* (MO, VEN).

This species is closely related to *Lepanthes dussii* Urban and *L. unitrinervis* Carnevali & I. Ramírez, both occurring in the highlands of the Venezuelan Guayana. *Lepanthes marahuacensis* is easy to distinguish from these two species by its proliferous ramicauls and a much more elongate column. *Lepanthes unitrinervis* is known only from Ilú-tepui and Cerro Roraima in Estado Bolívar, while *L. marahuacensis* is known from the summit of Cerro Marahuaca in Territorio Federal Amazonas; both species grow at elevations from 2,500 to 2,700 m. *Lepanthes dussii* was described from Guadeloupe in the Lesser Antilles; elsewhere it is known only from two very distant stations in the Venezuelan Guayana (Gran Sabana and Cerro Neblina) at 1,200–1,500 m. Several other species of *Lepanthes* show similar patterns of distribution. *Lepanthes cercion* Luer, *L. pariaensis* Foldats, and *L. pectinata* Luer occur only in the Peninsula de Paria, an area known to have a floristic relationship with the Antilles, and in the Guayana Highlands of Venezuela and Brazil. *Lepanthes duidensis* Ames & C. Schweinfurth is known to occur outside the Guayana area only in the Isla de Margarita, also known for its floristic relationship with the Antilles and located very close to Paria. *Brachionidium parvum* Cogniaux also shows the same basic distributional pattern.

Lepanthes pariaensis Foldats Acta Bot. Venez. 3: 339, fig. 11. 1968.

This species is common and widespread in the Venezuelan Guayana in cloud forests at elevations of 750–1,500 m. The populations from this area have more pubescent petals than those of the typical population. Recently, it was collected for the first time in Brazil.

Specimens examined. BRAZIL. **Amazonas:** plateau of N Massif of Serra Aracá, 0°51–57′N, 63°21–22′W, 1,400 m, cloud forest, 17 Feb. 1984, *Prance et al. 29125* (INPA, NY, VEN); same locality, 21 Feb. 1984, *Prance et al. 29201* (INPA, NY, VEN).

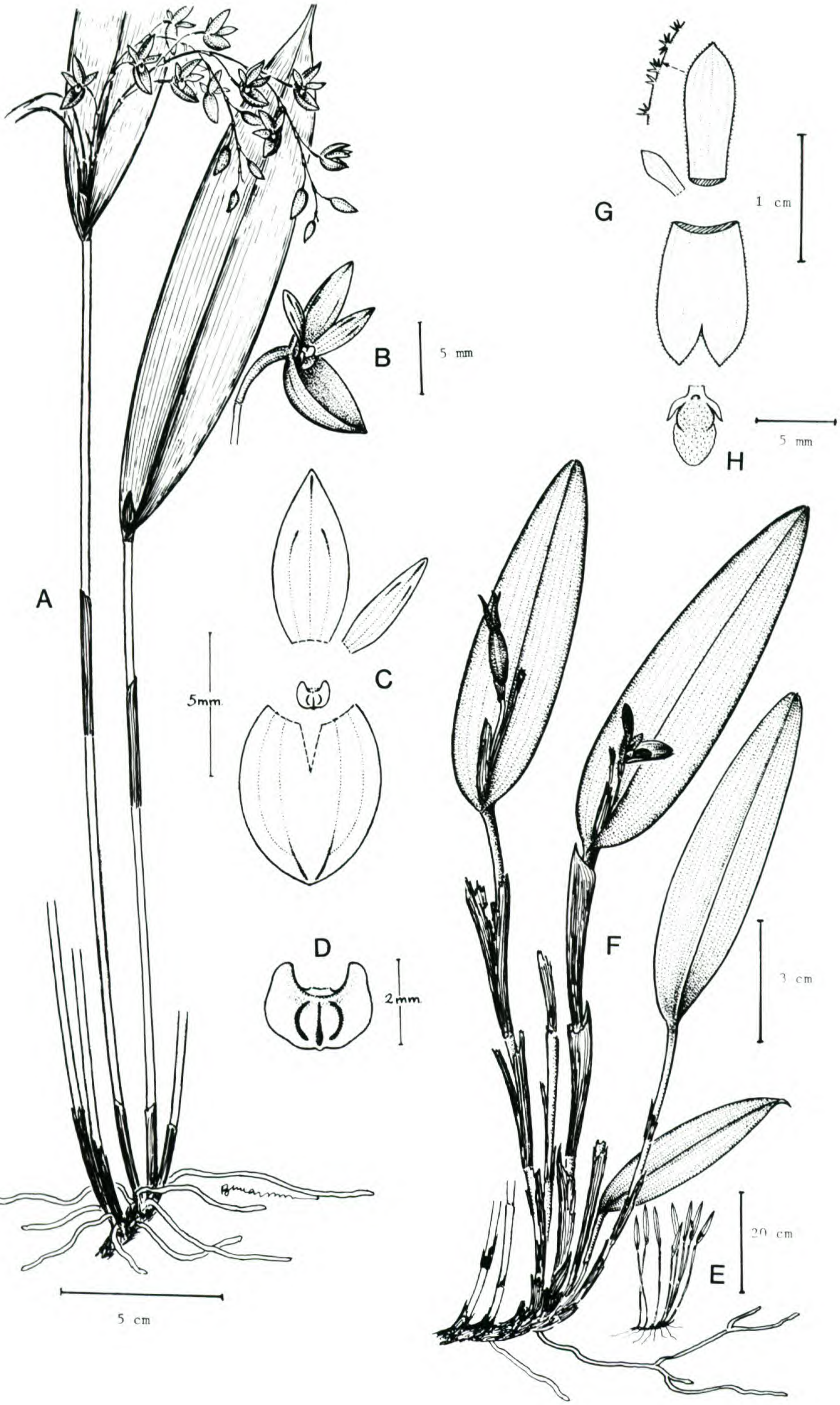
Lepanthes unitrinervis Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Bolívar: Ilú-tepui, lower plateau with varied habitats, rocky, boggy, shrubby and short forest to 5 m tall, 5°25′36″N, 60°29′W, 2,500 m, 16 Apr. 1988, "in crack in rock. Flower buds reddish purple," *Liesner 23433* (holotype, VEN; isotype, MO). Figure 7D–H.

Species *Lepanthi dussii* Urban affinis sed ramicaulium vaginis scabrosis; rhachidis internodiis pedicellos 3–4-plo excedentibus; sepalis lateralibus in quartam partem basalem tantum connatis; petalorum lobis angustioribus, longioribusque; labello bilobato differt.

Epiphytic herbs, small to minute, erect, muscicolous, caespitose. Roots proportionately thick and long. Ramicauls 5–8 mm long, enveloped by 3 tightly fitting, minutely scabrous, lepanthiform sheaths. Leaves 9–10 mm long, 6–7 mm wide, fleshy, broadly elliptic, apically obtuse to subrotund, basally attenuated into a twisted, 2–2.5 mm long, broadly channeled pseudopetiole. Inflorescence 25–30 mm long, a long peduncled, laxly 1–3-flowered raceme. Peduncle 20 mm long, 3-bracted. Floral bracts 1.2 mm long. Pedicels 0.8 mm long, 3–4 times shorter than internodes of rachis. Flowers apparently nodding. Fruiting ovary 1.8 mm long. Dorsal sepal 4.2 mm long, 2.4 mm wide, 3-nerved, dorsally carinate, ovate-elliptic, acuminate. Lateral sepals 5 mm long, 2.3 mm wide, 1-nerved, connate in basal fourth, ovate elliptic, acuminate, carinate. Petals 2.2 mm long, 0.5 mm wide, transversely narrowly elliptic, inconspicuously bilobed with both lobes somewhat falcate, the upper obtuse, the lower truncate; margins ciliolate. Labellum bilaminate, the blades 2 mm long, minutely pubescent, elliptic-lunate with obtuse upper end and acute lower end, overlapping when expanded; connectives and body broadly cuneate, connate to very base of column, dorsally pubescent; sinus elliptical with a very small, subtriangular appendix. Column 1.8 mm long, elongate-subterete, dorsally carinate, minutely pubescent. Anther dorsal. Stigma apical.

Paratype. VENEZUELA. **Bolívar:** Cerro Roraima, valley of Río Arabapo, 2,600 m, Sep. 1976, *Dunsterville 1356* (AMES).

This taxon is closely related to *Lepanthes marahuacensis*, from which it differs chiefly by its nonprolific ramicauls, the more obtuse basal lobes of its


A
5 cm
B
5 mm
C
5mm
D
2mm
E
20 cm
F
3 cm
G
1 cm
H
5 mm

labellum, and its shorter column. It is distinguished from *L. dussii* by its scabrous, nonpilose, cauline sheaths, clearly bipartite labellum, more transverse petals with narrower lobes, and a less crowded rachis. The name refers to the 1-nerved lateral sepals and the 3-nerved dorsal sepal.

Myoxanthus

Myoxanthus aspasicensis subsp. **arenicola** Carnevali & I. Ramírez, subsp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Departamento Atabapo, Cerro Huachamacari, E slope, rainforest, 03°49′N, 65°42′W, 600–700 m, 3 Nov. 1988, "terrestrial, flowers red-purple inside," *Liesner 25776* (holotype, VEN; isotype, MO). Figure 9E–H.

Myoxanthus aspasicensis subsp. *aspasicensis* similis sed habitu arenicola, rhizomate valde elongato, foliis ramicaule brevioribus vel raro hunc subaequantibus, basi obtusa rotundatave vel raro subacuta (vs. cuneata vel acuta), 7.5–13 cm longis, 1.5–3.3 cm latis (vs. 16–25 × (3.5–)5–6.5 cm), sepalo postico 11–13 mm longo, 2.1–2.7 mm lato (vs. 17 × 6 mm), petalis 3–4 mm longis, 1–1.3 mm latis (vs. 6 × 2 mm), labello synsepalo 2-plo breviore (vs. 3-plo breviore).

Erect herbs, medium-sized, psammicolous to lithophytic on sandstone, very rarely epiphytic, growing in sun or shade. Rhizome horizontal to suberect, short to long, relatively thick, bearing ramicauls at intervals of 6–11 mm, entirely concealed by scarious, defibrating sheaths. Roots thick. Ramicauls 8–20 cm long, terete, apically unifoliate, 4-articulate; each articulation entirely clothed by a tubular sheath; sheaths papery, apiculate eventually defibrating and deciduous, brown-pustulose, especially the lower ones. Leaves 7.5–12.5 cm long, (1.5–)1.7–3.0(–3.3) cm wide, thickly coriaceous, perpendicular to ramicaul or nearly so, narrowly oblong-elliptic or elliptic to oblong-elliptic, apex obtuse or subacute to (rarely) almost rounded, base obtuse or rounded to (rarely) subacute. Inflorescences uniflorous, fasciculate, originating from a conspicuous spathe about 1–2 cm long. Peduncle 1.4–2.2 cm long, terete, hispid, basally clothed by 1–2 tubular, imbricate, hispid sheaths. Floral bract 3–4.5 mm long, tubular, hispid, apiculate, completely enclosing the pedicellate ovary. Pedicel 1.5–3 mm long, stout, terete, subglabrous. Ovary 3–3.5 mm long, obconic, stout, hispid. Flowers medium sized, 15–20 mm long, open, fleshy, resupinate. Sepals with pubescence in small mounds on the outer face and at margins. Dorsal sepal 11–13 mm long, 2.1–2.7 mm wide, 5-nerved, oblong-elliptic, obtuse or acute, somewhat concave. Lateral sepals 10–12 mm long, 3.5–4.5 mm wide, 3-nerved, coherent into an elliptic synsepal; synsepal 7–8 mm wide, rounded or broadly obtuse, concave, free in apical third. Petals 3–4 mm long, 1–1.3 mm wide, 3-nerved, narrowly elliptic to oblong, obtuse or subacute to somewhat subulate-attenuate. Labellum 4.5–5 mm long, 2–2.8 mm wide, fleshier than other perianth segments, articulate with column-foot, somewhat concave, elliptic in overall shape, apically rounded, the ventral face verruculose, with a pair of linear, uncinate lobes 0.5–0.9 mm long in basal fourth, and a pair of suboblong low lateral calli at middle, the disk with an inverted U-shaped callus near base and extending forward between lateral lobes as a pair of verruculose keels. Column somewhat arcuate, winged in upper third, 3.8–4.2 mm long. Capsule 3–4 cm long, oblongoid, hairy.

Paratypes. BRAZIL. **Amazonas:** Plató da Serra Aracá, 1,150–1,250 m, 21 Feb. 1984, *Tavares et al. 112* (NY). GUYANA. **Cuyuni–Mazaruni Region:** Timehri rock paintings, 2 km SSW of Maipuri Falls, 700–850 m, 5°40′N, 60°17′W, 23 Dec. 1989, *Gillespie & Smart 2865* (MO, US). VENEZUELA. **Bolivar:** El Paují, 900 m, 4°30′N, 61°36′W, 8 Nov. 1985, *Liesner 10745* (MO, VEN); Cerro Jaua, 1,850–1,920 m, 4°48′50″N, 64°34′10″W, 28 Feb. 1974, *Steyermark et al. 109455* (VEN), *Steyermark et al. 109814* (VEN); La Escalera, 20 Aug. 1979, *Stergios & Rodriguez 6646* (PORT, VEN); Auyán-tepui, 1,200 m, 17 Sep. 1968, *Foldats 7174* (VEN); 201 km S of El Dorado, 1,200–1,400 m, 22 Feb. 1972, *Steyermark et al. 105498* (VEN); Río Paragua, Oct. 1974, *Steyermark s.n.* (VEN); medio Río Paragua, minas de Maraima, 300 m, 6°7′N, 63°45′W, 13 June 1987, *Stergios 10253* (PORT, VEN); Cerro Guaiquinima, 750 m, 5°44′4″N, 63°41′8″W, 24 Jan. 1977, *Steyermark & Dunsterville 113460* (VEN); Luepa, Gran Sabana, 1,250 m, 21 Oct. 1987, *Ramírez & Carnevali 147* (TFAV, VEN); Río Churún, *Dunsterville 296* (AMES, VEN). **Territorio Federal Amazonas:** Cerro Duida, 1,350 m, 3°10′N, 65°31′W, 11 Feb. 1975, *Tillett 752-161* (MYF, VEN); Cerro Duida, Sep. 1977, *Tillett et al. 752-299* (MYF, VEN); Cerro Neblina, 15 Apr. 1984, *Gentry & Stein 46661* (MO, VEN), 15–18 Mar. 1984, *Liesner 16690* (MO); Cerro Yapacana, 825–1,000 m, 3°45′N, 66°45′W, 7 May 1970, *Steyermark & Bunting 103147* (MY, VEN).

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Figure 9. A–D. *Pleurothallis elvirana.* —A. Flowering plant. —B. Flower. —C. Perianth segments, flattened. —D. Labellum (based on *Liesner & Stannard 16898*). E–H. *Myoxanthus aspasicensis* subsp. *arenicola.* —E. Old plant, showing creeping habit. —F. Flowering habit. —G. Perianth segments, showing detail of external pubescence. —H. Labellum, flattened (based on *Liesner 25776*).

This new subspecies is apparently restricted to the sandstone outcrops and sandy soils derived from the Roraima Formation in southern Venezuela, Guyana, and northern Brazil. *Myoxanthus aspasicensis* subsp. *arenicola* usually grows in open situations, in full sun or under light shrubs. It has been repeatedly cited in the literature of Venezuelan orchids as *Pleurothallis uncinata* Fawcett & Rendle [*B. uncinata* (Fawcett & Rendle) Luer] (Dunsterville & Garay, 1959; Foldats, 1970), a taxon occurring from Belize to Panama and in Jamaica. The closest relative of this new taxon is *M. aspasicensis* subsp. *aspasicensis* (Reichenbach f.) Luer, which it resembles in its creeping rhizome, the relatively broad leaves for the species complex, and the broad, verruculose, apical lobe of its labellum. *Myoxanthus aspasicensis* subsp. *arenicola* is easily distinguished from the typical subspecies by its smaller stature, sand-loving habit, more clearly creeping rhizome, smaller leaves that are almost always shorter than the ramicaul with a rounded or obtuse to very rarely subacute base, shorter spathe (1–2 cm long vs. 3–4 cm long), smaller flowers (dorsal sepal 11–13 mm long, 2.1–2.7 mm wide vs. 17 mm long, 6 mm wide), and labellum, which is about 2 times shorter than the synsepal (in the typical subspecies it is about 3 times shorter). The typical subspecies is mainly an Andean taxon known from Costa Rica, Colombia, Ecuador, and Bolivia. *Myoxanthus aspasicensis* subsp. *arenicola* was illustrated and described by Dunsterville & Garay (1959: 354–355) as *Pleurothallis uncinata* Fawcett & Rendle; the drawing is somewhat misleading because it does not show the verrucae on the ventral face of the labellum.

Octomeria R. Brown

Octomeria exigua C. Schweinfurth, Bot. Mus. Leafl. 3: 86. 1935. TYPE: Guyana. Arakaka: Hoodsline, Feb. 1896, *Im Thurn 115b* (holotype, AMES; isotype, K).

Octomeria exigua var. *elata* C. Schweinfurth, Bull. Torrey Bot. Club 75: 216. 1948. TYPE: Guyana. Kaieteur Plateau, 5 May 1944, *Maguire & Fanshawe 23256* (holotype, AMES; isotype, NY).

Octomeria deltoglossa Garay, Bot. Mus. Leafl. 18: 201. 1958. TYPE: Venezuela. Bolívar: Río Carrao, July 1955, *Dunsterville 289* (AMES).

Octomeria kestrochila Garay & Dunsterville, Ven. Orch. Ill. 6: 288. 1976. TYPE: Venezuela. Territorio Federal Amazonas: Cerro Yapacana, 1,100 m, 5 May 1970, *Steyermark 103130* (holotype, AMES; isotype, VEN).

The study of numerous herbarium specimens, including the types and abundant living material has shown that these four concepts belong to one variable species, widespread in the Guayana Highlands in Guyana and Venezuela, at elevations of 450–1,500 m. The labellum varies in shape from elliptic (as in *O. kestrochila*) to oblanceolate-obtrullate (as in the types of the other three taxa). The surface of the labellum varies from verrucose to almost smooth, with all intermediate stages, sometimes even in the same population. The plants are also rather variable in stature, ranging from 5 to 20 cm in height; the leaves can be shorter or longer than the ramicaul.

Selected specimens examined. GUYANA. **Arakaka:** Hoodsline, Feb. 1896, *Im Thurn 115* (AMES, K); Kaieteur Plateau, 5 May 1944, *Maguire & Fanshawe 23256* (AMES, NY). VENEZUELA. **Bolívar:** 12 km N of Aparamán-tepui, 950 m, Sep. 1986, *A. Fernández 3526* (MYF, VEN), Chimantá tepui, Río Tirica, 1,000 m, May, *Steyermark 75571* (VEN); La Escalera, 500–1,200 m, Jan. 1962, *Foldats 2861, 2883* (both VEN); Amarway-tepui, 600–900 m, Dec. 1986, cultivated from material collected by R. Liesner & B. K. Holst, *Carnevali 2065* (VEN); Cerro Sarisariñama, 700–1,350 m, Feb. 1974, *Steyermark et al. 109260* (VEN), *109091* (VEN). **Territorio Federal Amazonas:** Cerro Sipapo, 1,400 m, *Maguire & Politi 27727* (NY, VEN); Cerro Yapacana, 1,000–1,200 m, 5 May 1970, *Steyermark & Bunting 103130* (AMES, VEN); Cerro Duida, 1,440 m, 1931, *Tate 554* (NY); Serranía de Yutajé, 5°41′N, 66°09′W, 1,000–1,050 m, 3 Mar. 1987, *Liesner & Holst 21563* (MO, VEN).

Octomeria gemmula Carnevali & I. Ramírez, Ernstia 39: 15. 1986.

We here report this species for the first time from Colombia.

Specimen examined. COLOMBIA. **Vaupés:** Río Piraparaná (tributary of Apaporis), between 0°15′S, 70°30′W and 0°25′N, 70°30′W, 18 Sep. 1952, *Schultes & Cabrera 17516* (AMES, MO).

Pleurothallis R. Brown

Pleurothallis elvirana Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Departamento Río Negro, Cerro de La Neblina, Camp 5, valley N of base of Pico Cardona, 1,250 m, 0°49′N, 66°0′W, 21–24 Mar. 1984, *Liesner & Stannard 16898* (holotype, VEN; isotype, MO). Figure 9A–D.

Species haec in *Pleurothallis lindeniae* Lindley complexu his concurrentibus notis distinguitur: planta elongata (50 cm attinenti); foliis ellipticis; inflorescentiis pendulis 5–8 floris; floribus luteis parvis, haud estriatis; petalis ellipticis; labello 3-nervato, ecalloso vel subecalloso, apice truncato. (Subgenus *Pleurothallis*, sect. *Pleurothallis*, subsect. *Macrophyllae–Racemosae.*)

Epiphytic herbs, erect, densely caespitose, 30–50 cm high. Roots many, relatively thick. Ramicauls 20–35 cm long, terete, clothed by 2 tubulose, scarious sheaths, the lower 1.5–2 cm long, the upper 3.5–4 cm long. Leaves 14–17 cm long, 2.1–3.5 cm wide, erect, coriaceous, narrowly elliptic to narrowly obovate-elliptic, acute, the apex acuminate, tridenticulate, the base subcuneate. Inflorescences 5–8-flowered pendulous racemes to 9 cm long, 1–4 simultaneously from a fibrous sheath 4–5 mm long, ramicauls producing up to 8 racemes; peduncle subterete; rachis straight. Floral bracts 3.5–4.5 mm long, tubulose, basally appressed to rachis, apically expanded and cupuliform with attenuate apex. Pedicel and ovary subterete; pedicel 4–5 mm long; ovary 2.5 mm long. Flowers not resupinate; perianth segments expanded, subfleshy, yellow, glabrous. Dorsal sepal 6.5–7.5 mm long, 3.5–4 mm wide, 3-nerved with shorter lateral nerves extending only to apical third, elliptic, obtuse to subacute, abruptly pointed apically. Lateral sepals 6–6.5 mm long, 4.5–5.5 mm wide when expanded, 4-nerved, connate into a broadly elliptic, concave synsepal. Petals 5–5.5 mm long, 1.4–1.6 mm wide, 3-nerved, fleshier than sepals, apically thickened, narrowly ovate-elliptic, acute, slightly oblique. Labellum 1.8–2 mm long, 2.2–2.5 mm wide when expanded, fleshy, broadly ovate or transversely oblong, apically rounded or subtruncate, with a small, rounded mucro, with three prominently raised nerves in dry material, these inconspicuous when rehydrated; disk ecallose or with 2 inconspicuous pulvinate calli 0.1 mm high. Column 1.5–1.7 mm long, subconic or cylindric, footless; anther apical; stigmatic surfaces 2, apical.

This new species belongs to the *Pleurothallis lindenii* complex, a group composed of many interrelated species that differ only in subtle ways. Many of these species are only known from one mountain or mountain range. *Pleurothallis elvirana* is the first species in this complex to be collected in the Guayana area; all the other species are from the Andean Range or the Coastal Cordillera of Venezuela. *Pleurothallis elvirana* can be distinguished from most of its relatives by its 3-nerved labellum, which is ecallose or with two inconspicuous, pulvinate calli, and has a truncate apex provided with a small, rounded, apical mucro. There are two other species in this complex with ecallose labella: *P. aporosis* Luer and *P. decora* Luer, from Ecuador and Colombia respectively, but in these two species the labellum is longer than wide, while it is wider than long in the new species. The species is named after Elvira Cotton, from Venezuela, who distributed the material collected during the Neblina Project.

Pleurothallis morilloi Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Táchira: on Río San Buena, 10 km E of La Fundación, primary areas around Represa Dorada, forest evergreen, soils tending to be sandy, derived from metamorphic rock (schist or gneiss), 700–1,000 m, 7°47–48′N, 71°46–47′W, 13–14 Mar. 1980, *Liesner, Gonzalez & Smith 9535* (holotype, VEN; isotype, MO). Figure 10.

Pleurothallis chamensi Lindley affinis, statura vegetativa manifeste minore differt; rhizoma elongata prostrate; foliis basaliter cuneatis, quam caulibus secundariis longioribus vel subaequalibus; inflorescentiis tantum 1–3-floris; floribus minoribus; sepalo dorsali extus carinato trianguliter oblongo; petalis vix inconspicue serrulatis; labelo leviter carnoso. (Subgenus *Acianthera* sect. *Sicariae* subsect. *Sicariae*.) Figure 6.

Epiphytic herbs, shortly creeping, shade-loving, 4–5.5 cm high. Roots filiform. Rhizome 4–8 cm long, terete, with 2–4 articulations between ramicauls. Ramicauls 1.1–2.2 cm long, 0.4–1.5 cm wide, erect to horizontal or subpendulous, basally ancipital, apically triquetrous. Leaves 2.3–3.2 cm long, 1–1.7 cm wide, erect to horizontal, fleshy-coriaceous, elliptic to ovate, obtuse to acute, apically minutely bidenticulate, basally cuneate or rounded to (rarely) subcordate, the midrib abaxially prominent. Inflorescences in fascicles of 1–3 but only 1 fertile at any given time, 1–3-flowered, with 1–2 flowers in simultaneous anthesis; peduncle 0.2–0.4 cm long. Pedicellate ovary ca. 2.3 mm long, 6-ribbed, two-winged, hence triquetrous, 5 mm long after pollination. Floral bracts 0.5 mm long, green, broadly triangular, obtuse to acute. Flowers erect to suberect, not opening completely, sometimes cleistogamous; perianth segments rigid, subfleshy, greenish yellow; labellum greenish white. Sepals 3-nerved, concave, dorsally carinate, the carinae continuous over ovary. Dorsal sepal 4 mm long, 0.9–1.1 mm wide, 3-nerved, oblong to oblong-elliptic, acute. Lateral sepals 3.5 mm long, 1.3 mm wide, 3-nerved, triangular-ovate, acute, connate in basal ¼ to ⅔ into an oblong-elliptic synsepal. Petals 2.3 mm long, 0.4 mm wide, hyaline, 1-nerved, linear oblong, obtuse to acute, the apical margins finely and irregularly serrulate. Labellum 2.5 mm long, 1.3–1.5 mm wide, membranous, 3-nerved, ovate-elliptic, the apex rounded to broadly obtuse, minutely erose, simple, concave, ecallose, the basal margins erect. Column 2 mm long, slightly recurved, with two small apical wings. Anther apple-green or yellow, papillose. Pollinia 2.

Paratype. VENEZUELA. **Bolivar:** Río Aonda (Auyántepui), ca. 600 m, Mar. 1969, *Dunsterville 1108* (AMES, line drawing AMES).

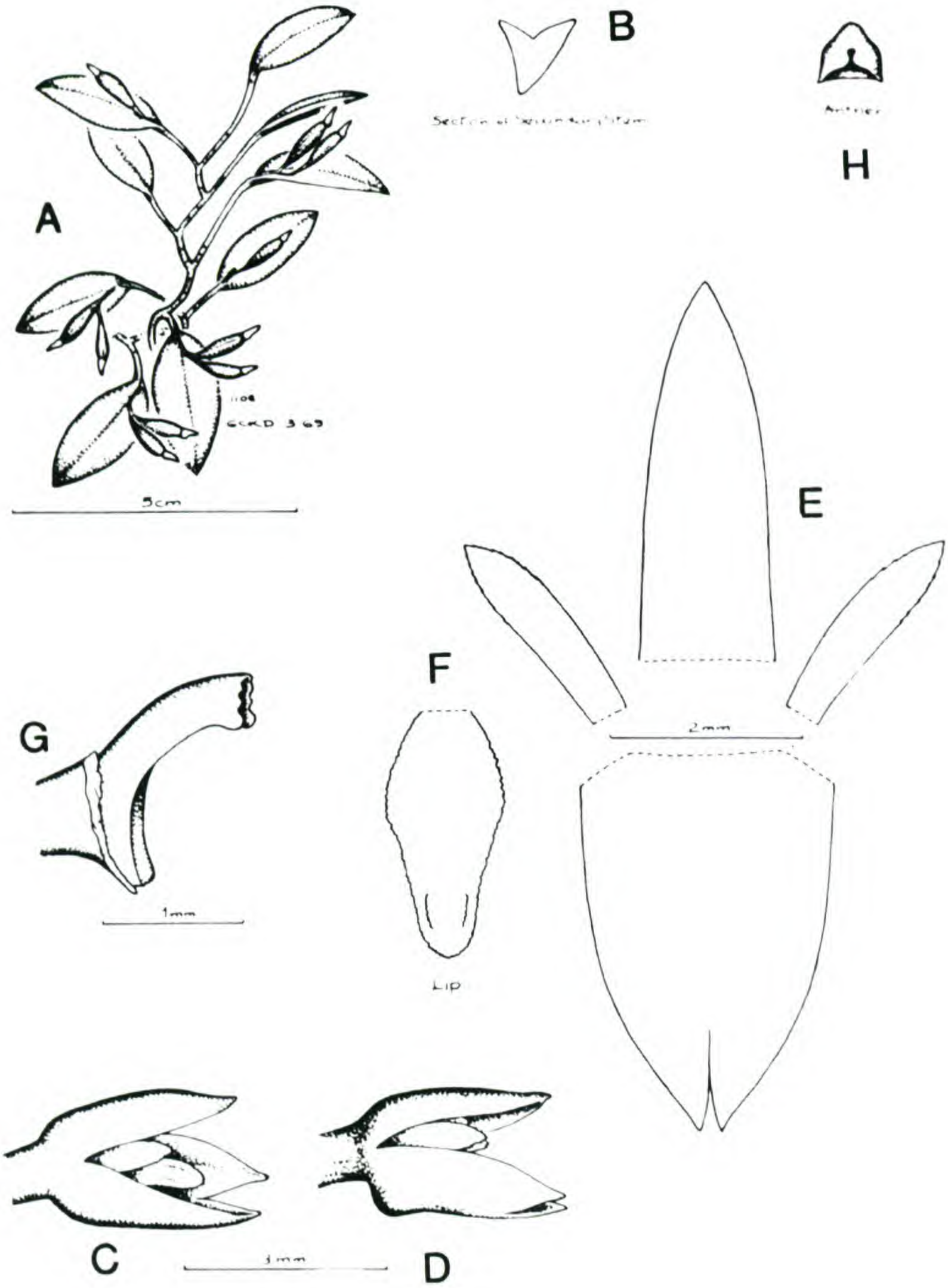

Figure 10. *Pleurothallis morilloi.* —A. Fruiting habit. —B. Cross section of ramicaul. —C, D. Two lateral views of flower at anthesis. —E. Sepals and petals, flattened. —F. Labellum, flattened. —G. Column. —H. Anther (based on *Dunsterville 1108;* illustration by G. C. K. Dunsterville, courtesy of AMES).

This small creeping species, named after Gilberto Morillo, former curator at VEN, is closely related to *P. chamensis* Lindley. *Pleurothallis morilloi* differs from Lindley's species by its smaller vegetative and floral dimensions, its long creeping rhizome, its cuneate leaves subequal to the length of the ramicaul, its 1–3-flowered inflorescence, and its dorsal sepal which is dorsally carinate and triangular-oblong (linear-oblong to linear spathulate in *P. chamensis*); furthermore, the petals are only minutely serrulate and the labellum is thinly membranous in *P. morilloi. Pleurothallis chamensis* is a species of medium to high elevations, while *P. morilloi* is found at lower elevations (to 1,000 m). Living material of this species was collected by the first author close to the town of Wonkén, Akaruai River, Estado Bolívar in 1984, but no voucher of it was made. *Pleurothallis chamensis*, widely distributed and very common in the Venezuelan Coastal Range and in the Andes, is absent from the Guayana.

Pleurothallis tepuiensis Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Bolívar: Auyántepui, región del Oso, 2,200 m, 10 sep. 1958, *Pannier & Schwabe 1819* (VEN). Figure 11A–C.

(Species) *P. batillaceae* Luer affinis sed statura minore, foliis multo angustioribus (6–10-plo longioribus quam latioribus vs. 2–3-plo longioribus quam latioribus), inflorescentiis solitariis succesivis, synsepalo sepalum dorsale subaequante (vs. angustiore) differt. (Subgenus *Crocodeilanthe*.)

Epiphytic herbs, caespitose to shortly creeping, to 30 cm high. Rhizome short-creeping to ascending, clothed by scarious sheaths. Ramicauls 9–17 cm long, terete, basally enclosed in a series of large scarious sheaths, the lowermost enclosing 1–3 ramicauls, the ramicauls with a tubular median sheath. Leaves 6–12(–14) cm long, 1.4–1.8(–2.5) cm wide, coriaceous, linear-elliptic to narrowly oblong-elliptic, apically obtuse, minutely tridenticulate, basally attenuate into a pseudopetiole 1.5–2 cm long. Inflorescences 4–12 cm long, solitary in anthesis but produced in succession, racemose, laxly to subdensely 10–25-flowered, bearing flowers from very base, subtended by a conduplicate spathe 1.3–2 cm long. Floral bracts 1.5–2.3 mm long, cupuliform. Pedicel ca. 2 mm long; ovary 1–2 mm long, ridged, arcuate. Flowers campanulate, hyaline with purplish nerves, nodding, glabrous. Sepals subfleshy, dorsally carinate, concave; dorsal sepal 3.5–4 mm long, 2.5–3 cm wide, 3-nerved, elliptic, broadly acute; lateral sepals connate about half their length into a synsepal 3.5–4.5 mm long, 2–3 mm wide, the free portions 2-nerved, triangular-elliptic, acute. Petals 2.7–3.2 mm long, 0.8–0.9 mm wide, 1- to obscurely 3-nerved, narrowly oblong to narrowly oblong-oblanceolate, apically rounded to subtruncate. Labellum 1.8–2.2 mm long, 1.7–1.9 mm wide, articulate to column-foot, fleshier than other perianth segments, 3-nerved, concave in natural position, broadly obovate in outline when expanded, basally attenuate into an elliptic to oblong, concave claw, this separate from blade by a transverse bar; blade 3-lobed in the apical third, the lateral lobes 1 mm long, 0.4–0.5 mm wide, callose-thickened, triangular-semilunate, rounded, the central lobe 0.5–0.6 mm long, 0.8 mm wide, very broadly ovate, rounded to subtruncate, thickened, the ventral surface rough. Column 1.2–1.3 mm long; column-foot 0.4 mm long, finely papillose.

Paratypes. VENEZUELA. **Bolívar:** Meseta del Jaua, Cerro Jaua, cumbre, 4°48′50″N, 64°34′10″W, al 0 del tributario del Río Marajano, 1,800 m, 24 feb. 1974, *Steyermark et al. 109446* (VEN); Cerro Sarisariñama, cumbre, porción NO, 4°41′40″N, 64°13′20″W, 700 m, 12–15 feb. 1974, *Steyermark et al. 109105* (AMES, VEN).

This species belongs to the *Pleurothallis galeata* Lindley complex, composed of many very closely related species. *Pleurothallis tepuiensis* is similar to the Andean *P. batillacea* Luer, from which it differs by its much narrower leaves, its smaller size, by producing successive, solitary inflorescences, and by its synsepal as broad as the dorsal sepal, not narrower as in Luer's taxon. The flowers of both species are very similar, but the vegetative characters and minor floral features make them clearly distinct. *Pleurothallis tepuiensis* is restricted to dwarf forests on tepui summits at elevations of 700–2,200 m.

Stelis Swartz

Stelis gemma Garay, Orquideología 4: 77, fig. 1969.

This unique species, easy to recognize by its short, congested inflorescences, relatively large, white flowers, 7-nerved sepals, and wide leaves, had been collected in Peru in 1959, but the material remained unidentified until now. It was previously known from Ecuador and Colombia.

Specimen examined. PERU. **Huánuco:** Muña, 7 Mar. 1959, *Woytkowski 5241* (MO).

Stelis umbelliformis Hespenheide & Dressler subsp. **brevipedunculata** Carnevali & I. Ramírez, subsp. nov. TYPE: Colombia. Nariño: Municipio de Tumaco, km 63 carretera Tumaco–Pasto, Vereda El Carmen, 240 m, 19 feb. 1984, *Benavides 4284* (holotype, PSO; isotype, MO).

A subsp. *umbelliformi* inflorescentia quam folia 2-plo breviore (vs. quam folia longiore), sepalis petalisque atropurpureis, petalis latioribus, margine acutis discrepat.

Although the floral differences between the subspecies are not particularly remarkable, the much shorter inflorescences make subspecies *brevipedunculata* distinctive. The typical subspecies is from the Province of Colón, Panama, and has inflorescences ranging from a little longer than the subtending leaf to about two times as long, petals with rounded to truncate upper and lower margins, and flowers described as "verdes con baño morado." In the new subspecies the inflorescences are half the length of the subtending leaf or shorter, the petals have acute to acuminate upper and lower margins, and the flowers are described as "color pardo oscuro." The two known populations of this species are separated by a distance of about 900 km.

Figure 11. A–C. *Pleurothallis tepuiensis*. —A. Flowering habit. —B. Lateral view of the flower. —C. Perianth segments flattened with two views of the labellum (based on *Steyermark et al. 109446*). D–F. *Eltroplectris calcarata*. —D. Flowering habit. —E. Flower. —F. Perianth segments, flattened (based on *Fernández 778*).

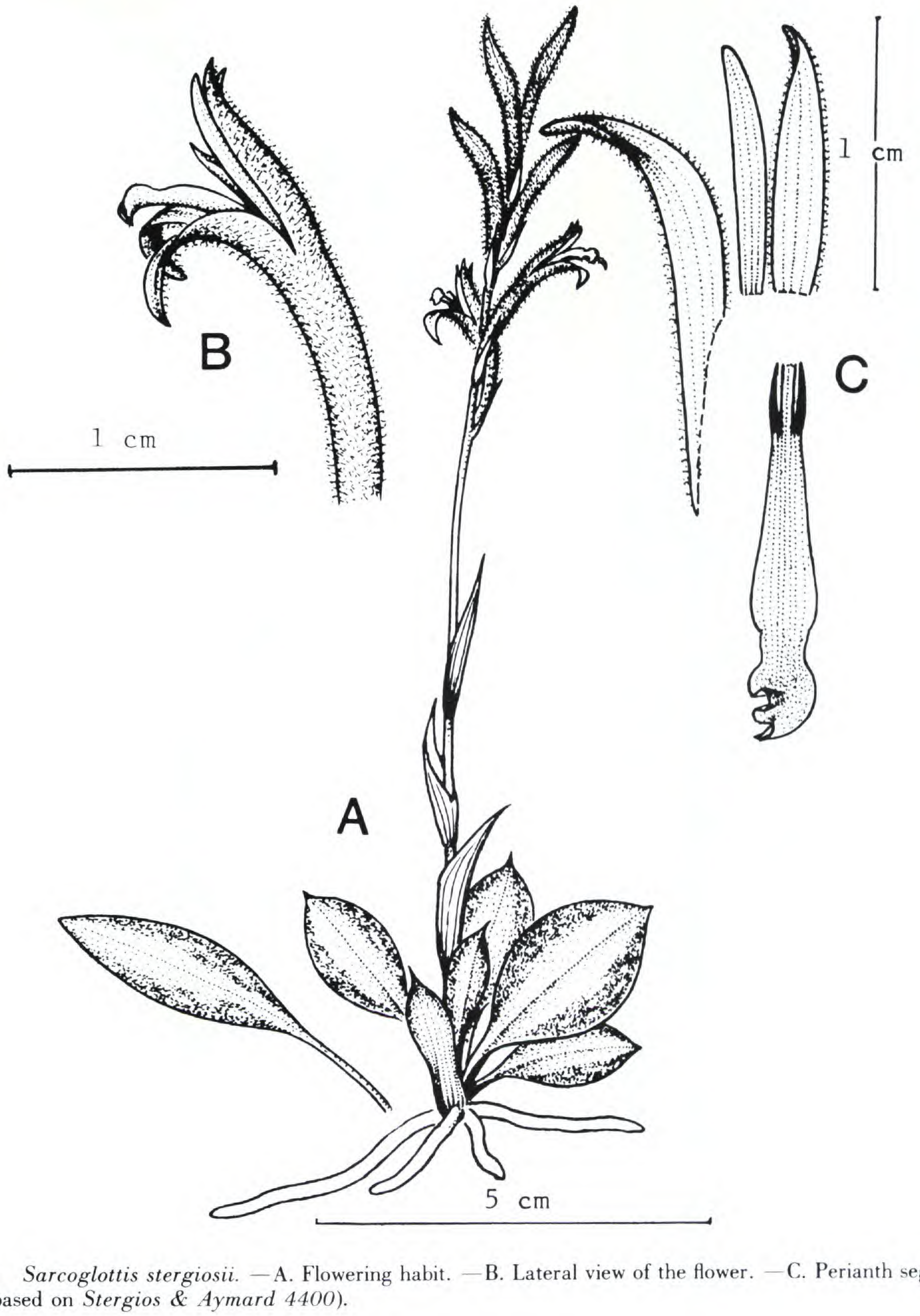

Figure 12. *Sarcoglottis stergiosii.* —A. Flowering habit. —B. Lateral view of the flower. —C. Perianth segments, flattened (based on *Stergios & Aymard 4400*).

SUBFAMILY ORCHIDOIDEAE

SUBTRIBE HABENARIINAE

Habenaria pygmaea C. Schweinfurth & R. Schultes, Amer. Orchid Soc. Bull. 23: 822, fig., 1954. TYPE: Colombia. Comisaría del Amazonas–Vaupés: Río Apaporis, Cachivera de Jirijirimo y alrededores, 250 m, 13 June 1951, *Schultes & Cabrera* (AMES).

Habenaria guanchezii Carnevali & I. Ramírez, Ernstia 33: 15. 1986, syn. nov. TYPE: Venezuela. Territorio Federal Amazonas: Departamento Atures, Río Guayapo, Raudal Moriche, 100–120 m, 20 Apr. 1984, *F. Guánchez 3085* (holotype, VEN: isotypes, MY, TFAV).

When we described *H. guanchezii*, we overlooked Schweinfurth's species. The Venezuelan material is almost identical to the type collection and

grows in the same kind of specialized psammicolous association. It is now known from Venezuela, Colombia, and Ecuador.

SUBFAMILY SPIRANTHOIDEAE

SUBTRIBE SPIRANTHINAE

Eltroplectris Rafinesque

Eltroplectris calcarata (Swartz) Garay & Sweet, J. Arnold Arbor. 53: 390, fig. 71. 1972. Figure 11D–F.

This showy species is scattered along its distributional range and may prove to be more common than the present collecting record indicates. Recently, it was collected twice in Venezuela; besides the specimen cited below we have seen living material from the Sierra de San Luis, in northwestern Venezuela. The Venezuelan material is intermediate between the "calcarata" form and the "setacea" form, confirming Garay & Sweet's (1972) opinion that they were just extreme forms of a variable complex. It is now known to occur in Florida, the West Indies, Colombia, Ecuador, Venezuela, and Brazil.

Specimen examined. VENEZUELA. **Bolívar:** Cerro Arimagua, close to Cerro Bolívar, 480 m, light semideciduous forest, Jan. 1985, *Fernández 778* (PORT, VEN).

Sarcoglottis C. Presl

Sarcoglottis stergiosii Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Departamento Río Negro, selva pluvial, alrededores de San Carlos de Río Negro y camino que conduce a Solano, 100–120 m, 23–29 July 1982, *Stergios & Aymard 4400* (holotype, VEN; isotypes, PORT, TFAV). Figure 12.

Plantae 10–16 cm alta. Folia 3–5, pseudopetiolata; lamina usque ad 6 cm longa, 1.8 cm longa, elliptica vel late elliptica. Bracteae anguste ovato-ellipticae, usque ad 13 mm longae; floribus albescentibus, parvulis, extus pilosis; sepalis 3-nervatis, 9.5–10 mm longis, 1.5–2 mm latis, anguste ellipticis; petalis 3-nervatis, 7.5 mm longis, 1 mm latis, lineari-ellipticis; labello 7-nervato, 13 mm longo, 2.5 mm lato, ambitu lineari-obovato, lobo apicali ovato-subrhombico, undulato, 2.7 mm longo, 2.5 mm lato, disco in triente superiore pubescente; columna usque ad 15 mm longa.

Terrestrial herbs, 10–16 cm high. Roots few, short, fleshy, lanuginose. Leaves 3–5, 2–6 cm long, 1–1.8 cm wide, present at anthesis, rosulate, somewhat oblique, elliptic to broadly elliptic, acute to rarely obtuse, basally cuneate and attenuate into a 1–1.5-cm-long channeled pseudopetiole, adaxially solid purple-brown or blotched or marbled with olive-green, abaxially deep green or solid purple. Scape 9–15 cm high, erect, laxly pubescent, terete, clothed by 4–6 sheaths 1.3–2.7 cm long, 4–4.5 mm wide, narrowly elliptic, acuminate, glabrous to glabrescent, longer than the internodes. Inflorescence densely 3–7-flowered, the rachis 2.1–3 cm long, subterete, laxly long pubescent. Flowers small for the genus, totally white. Ovary 12–15 mm long, slightly arcuate, subdensely long-pubescent. Floral bracts 9.5–13 mm long, 2.1–2.8 mm wide, narrowly ovate-elliptic, acuminate. Sepals externally subdensely pubescent; dorsal sepal 8–10 mm long, about 1.5 mm wide, narrowly elliptic, acute to obtuse, 3-nerved, concave; lateral sepals subparallel to column, with spreading apices, basally long-decurrent on ovarian wall, the free portions 8.5–9.5 mm long, ca. 2 mm wide, narrowly oblong-elliptic, obtuse, falcate. Petals 6.5–7.5 mm long, ca. 1 mm wide, 3-nerved, connate with dorsal sepal for ⅘ of their length, the apices somewhat divergent, narrowly elliptic, falcate, acute to subobtuse, glandular and with ciliate margins. Labellum 12–13 mm long, 2.5 mm wide, long-unguiculate, 7-nerved, linear-obovate, basally long-sagittate; basal lobes linear, 2.6–2.8 mm long; blade glabrescent, gradually widened toward apex from a narrowly oblong basal zone, slightly contracted in apical ¼ and then broadened into a deflexed apical lobe; apical lobe 2.5–2.7 mm long, ca. 2.5 mm wide, broadly ovate-subrhombic, obtuse, finely and densely short-pubescent, coarsely undulate. Column 5.6 mm long, narrow, ventrally pubescent; rostellum 1.2 mm long, laminar, soft, truncate-emarginate apically; stigmata confluent; anther narrowly ovate.

Paratype. VENEZUELA. **Territorio Federal Amazonas:** IVIC Study Area, 4 km E of San Carlos de Río Negro, 120 m, 01°56′N, 67°04′W, 21 Nov. 1977, *Liesner 3728* (VEN).

This new species can be distinguished from other species of *Sarcoglottis* by the following combination of features: small size (to 16 cm high); leaves solid purple-brown, blotched or marbled with olive-green, present at anthesis; inflorescences 3–7-flowered; flowers small, totally white; and broadly ovate-subrhombic, coarsely undulate apical lobe of the labellum. *Sarcoglottis stergiosii* is known only from the drainage of the Casiquiare and Negro rivers, where it is quite rare and forms small colonies in rather open, wet forests.

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Una Nueva Especie del Género *Erythroxylum* (Erythroxylaceae) de Antioquia, Colombia

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RESUMEN. *Erythroxylum plowmanianum* es una nueva especie de la región alrededor de la cuenca del Río Claro, Colombia, una zona conocida como rica en especies endémicas sobre rocas calcareas. La nueva especie se describe y se ilustra, y se discute su parentezco.

ABSTRACT. *Erythroxylum plowmanianum* is a new species from the region of the basin of the Claro River, Colombia, an area known to be rich in endemic species that grow on calcareous rocks. The new species is described and illustrated, and its relationships are discussed.

La región del Río Claro forma parte del Valle Medio del Río Magdalena, en las faldas orientales de la Cordillera Central de Colombia. Esta cuenca se conoce por sus bosques húmedos tropicales remanentes en las cuales actualmente se está llevando a cabo un inventario intensivo de la fitodiversidad. Al determinar especimenes para la publicación del listado de la flora, encontramos una nueva especie del género *Erythroxylum*, descrita a continuación.

Erythroxylum plowmanianum Cogollo & Pipoly, sp. nov. TIPO: Colombia. Antioquia: Mcpio. San Luís, Cañon del Río Claro, sector occidental, margen izquierda, subida a la Dolina, 350–475 m, 8 jul. 1983 (fl, fr), *Cogollo & Borja 476* (holótipo, JAUM; isótipos, COL, HUA, MO). Figura 1.

Quoad stipulas aristatas manifeste longitudinaliter striatasque sectioni *Rhabdophyllo* O. E. Schulz pertinet, et intra illam ob laminas membranaceas ellipticas vel oblongo-obovatas, stipulas persistentes, ad *E. fimbriatum* Peyritsch valde arcte affinis, sed ab ea ramulis longitudinaliter porcatis (non angulatis), aristis stipulinis 2 (non 3), integerrimis (nec fimbriatis), pedicellis fructiferis 3–3.5 (non 5) mm longis, lobis calycinis 0.5–1 (non 1–1.3) mm longis ad apices attenuatis (nec acutis) carinatis (nec planis) denique drupa oblonga vel ellipsoidea (non ovoidea) 10–13 (nec 6–8) mm longa statim separabilis.

Arbusto o árbol hasta 9 m de alto; ramitas flexuosas, canaliculadas a teretes, 1–1.5 mm de diámetro, entrenudos 5–30 mm de largo; corteza marrón, lisa a ligeramente fisurada longitudinalmente, escasamente lenticelada; estípulas persistentes, dísticas, erectas, adpresas por la base del tallo, membranáceas, triangular-ovadas, 1–2 mm de largo, ápice agudo, no fimbriado, con dos lacinias 0.3–0.5 mm de largo, el margen entero. Hojas dísticas, láminas membranáceas, elípticas, u oblongo-ovadas, ápice acuminado, base aguda, 4–9.5 cm de largo, 1.1–3.9 cm de ancho, nervadura central y secundaria emergente en la haz y envés, los nervios secundarios de 8–11 pares, rectos, anastomosándose de 4–7.5 mm del margen, envés no lineado, pero con panel central verdoso-pálido; pecíolos subteretes, 2–3 mm de largo, ca. 1 mm de diámetro, ligeramente planos adaxialmente. Flores fasciculadas, bisexuales, 1–2 por nudo, blanquecino-cremosas; brácteas florales membranáceas, oblongas, concavas, 0.5–1 mm de largo, abruptamente acuminadas en el ápice; pedicelo cilíndrico, estriado, en antésis 2–3 mm de largo, 0.5 mm de diámetro, en fruto elongándose hasta 3.5 mm de largo; cáliz 1.5–2 mm de largo, dividido ⅓–⅔ de su longitud, los lóbulos membranáceos a cartáceos, ovados, 0.5–1 mm de largo, ápice atenuado, carinados, concavos, no recurvados en fruto; pétalos membranáceos, ovados a elípticos, 2.8–3.2 mm de largo, 1.3–1.5 mm de ancho, ápice redondeado, ligeramente concavos, con un surco central prominente en la parte abaxial, el margen entero; lígula bilobada, ca. 2 mm de largo, la aurícula abaxial suborbicular, 1.3–1.5 mm de largo, 0.8–1 mm de ancho, la aurícula adaxial 0.8–1 mm de largo, 0.6–0.8 mm de ancho; copa estaminal 1.5–2 mm de largo; estambres dolichistiladas, los filamentos antisepalosos, 0.8–1 mm de largo, filamentos antipetalosos 1.3–1.5 mm de largo, las anteras suborbiculares, 0.2–0.3 mm de largo y ancho; ovario elipsoide, 1.3–1.5 mm de largo, 0.6–0.8 mm de diámetro, truncado en el ápice, los estilos

Figura 1. *Erythroxylum plowmanianum* Cogollo & Pipoly. —A. Hábito. —B. Apice ramular, mostrando las estípulas biaristadas. —C. Inflorescencia, mostrando las lígulas y copa estaminal. —D. Pétalo y lígula. —E. Androceo, mostrando los dos niveles de estambres. —F. Pistilo. —G. Lóbulo calicino, mostrando el ápice atenuado. —H. Fruto. A–G, del isótipo. H, de *Cogollo et al. 4275*.

3, unidos solo en la base, ca. 1 mm de largo, el estigma deprimido-capitado, ca. 0.3 mm de largo. Fruto drupáceo, oblongoide a elipsoide, 10–13 mm de largo, 3–5 mm de diámetro, rojo al madurar, agudo u obtuso en el ápice, endocarpio variablemente sulcado.

Distribución. Endémica a la región del Río Claro, y sus alrededores, en el Municipio de San Luís, Departamento de Antioquia, Colombia, 350–580 m.

Ecología. *Erythroxylum plowmanianum* crece en bosques húmedos con afloramientos calcáreos, actualmente relegados a remanentes debido a la destrucción forestal.

Etimología. Para nosotros es muy grato dedicar esta especie a la memoria de Timothy Plowman, anteriormente del Field Museum of Natural History, autoridad pre-eminente en la sistemática de la familia Erythroxylaceae y gran estudiante de la flora colombiana.

Erythroxylum plowmanianum pertenece a la sección *Rhabdophyllum* Schulz debido a sus estípulas longitudinalmente estriadas y aristadas. La sección contiene aproximadamente 45 especies dentro de las cuales *E. plowmanianum* es muy afín a *E. fimbriatum* Peyritsch. Sin embargo, se separa *E. plowmanianum* fácilmente por sus ramitas porcatas, estípulas biaristadas, enteras, pedicelos más cortos, lóbulos calicinos 0.5–1 mm de largo, atenuados, y carinados, y la drupa oblonga o elipsoidea y más larga.

Parátipos. COLOMBIA. **Antioquia:** Mcpio. de San Luís, Cañon del Río Claro, sector occidental, margen izquierda, subida a la Dolina, 350–450 m, 25 oct. 1983 (fl, fr), *Cogollo 814* (COL, HUA, JAUM, MO), 3 dic. 1983 (fr), *Cogollo 1036* (COL, JAUM, MO), 9 mar. 1984 (fr), *Cogollo 1442* (COL, JAUM, MO), 30 mar. 1984 (fr), *Cogollo 1470* (COL, JAUM, MO), 2 sep. 1984 (fl, fr), *Cogollo 1905* (COL, HUA, MO); vereda Las Confusas, Finca Las Confusas, 6°03′N, 74°48′W, 350–500 m, 10 abr. 1990 (fl, fr), *Cárdenas et al. 2677* (COL, JAUM, MO); corregimiento El Prodigio, 6°06′N, 74°48′W, 350–580 m, 24 jun. 1990 (fr), *Cárdenas et al. 2845* (COL, JAUM, MO), 22 sep. 1990 (fl, fr), *Cárdenas et al. 2920* (COL, JAUM, MO); Mcpio. Puerto Triunfo, alrededores de la gruta "El Condor," 5°56′N, 74°50′W, 350 m, 22 oct. 1989 (fr), *Cogollo et al. 4275* (COL, JAUM, MO).

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Paspalum longiaristatum (Poaceae: Paniceae), a New Serpentine Endemic from Goiás, Brazil, and the First Awned Species in the Genus

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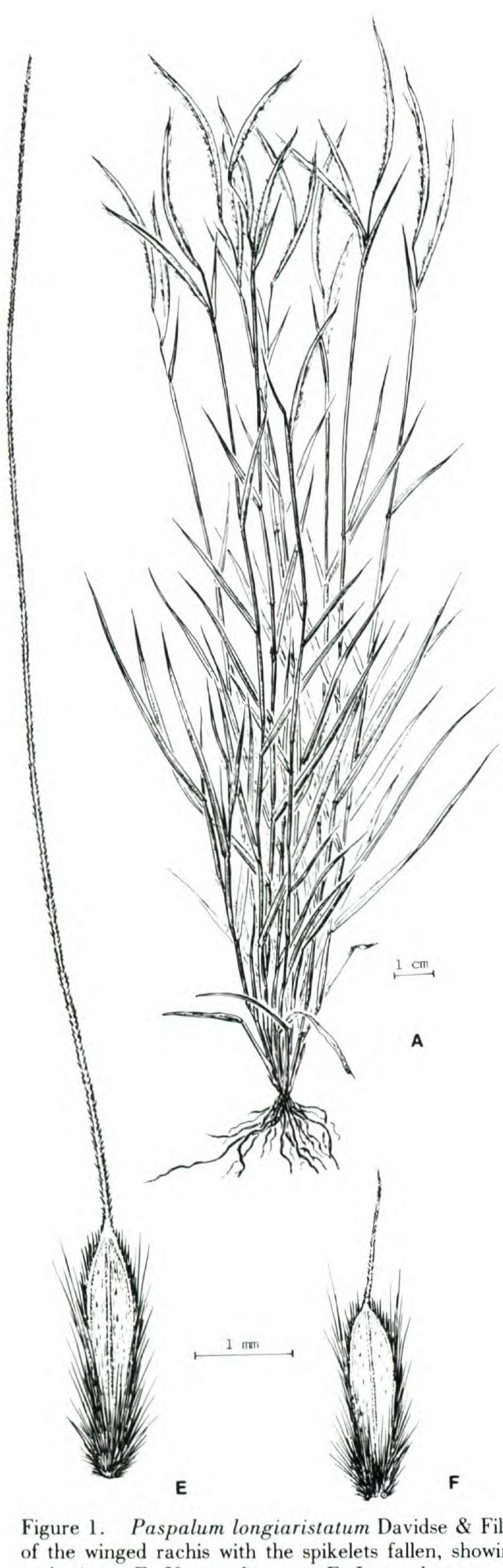
ABSTRACT. *Paspalum longiaristatum* of subgenus *Ceresia* is described and illustrated. It is the first known awned species in the genus and the first known annual species in the subgenus.

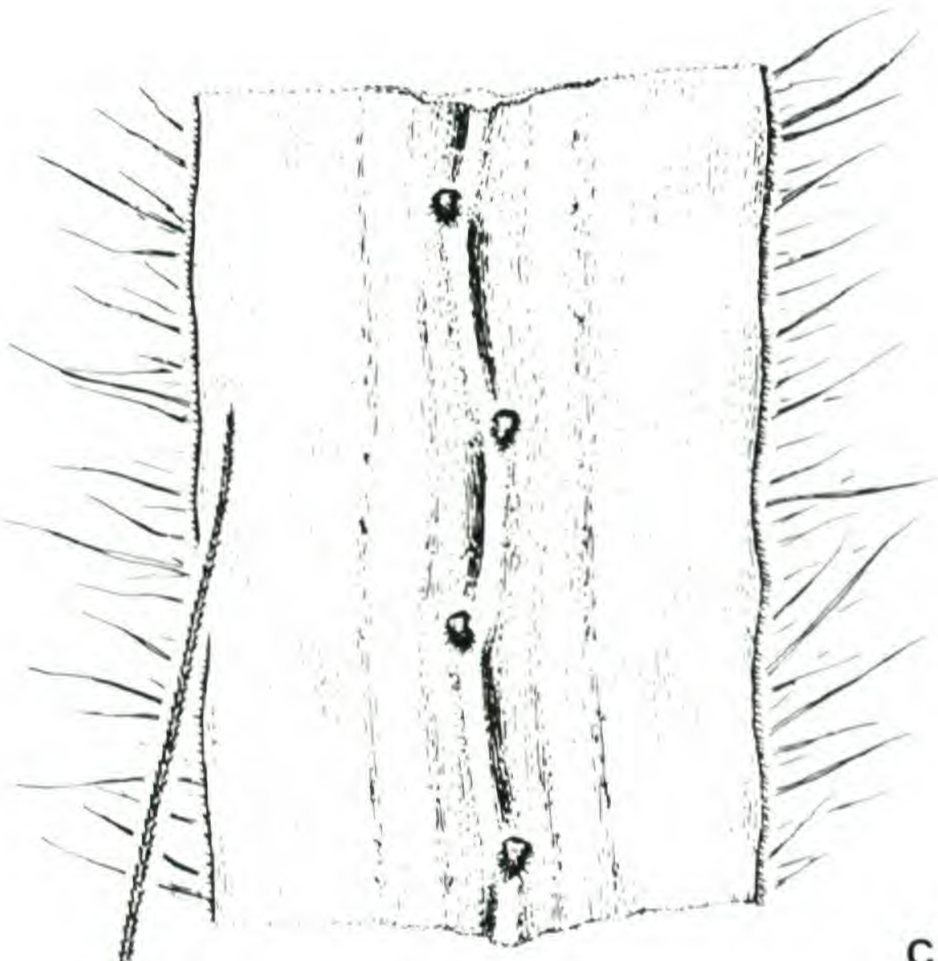
During routine determinations of grass specimens from the Brazilian state of Goiás, an unusual annual grass was studied, which we consider to represent an undescribed species of *Paspalum* L.

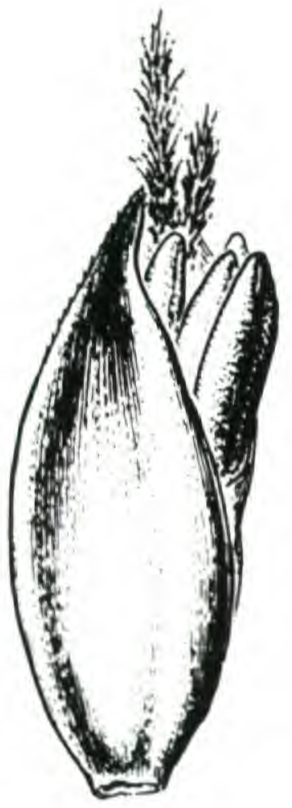
Paspalum longiaristatum Davidse & Filgueiras, sp. nov. TYPE: Brazil. Goiás: Niquelândia, Macedo, 14°18′S, 48°23′W, campo limpo, 13 abr. 1992, *T. S. Filgueiras 2277* (holotype, IBGE; isotypes, B, FLAS, ICN, ISC, K, MO, NY, P, SI, SP, R, RB, UB, UFG, US). Figure 1.

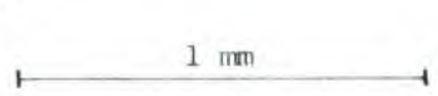
Ab omnibus speciebus *Paspali* gluma superiore et lemmate inferiore aristatis optime distincta. Speciebus subgeneris *Ceresia* (Persoon) Reichenbach simile sed habitu annuo, gluma superiore latissima super medianam partem absimile.

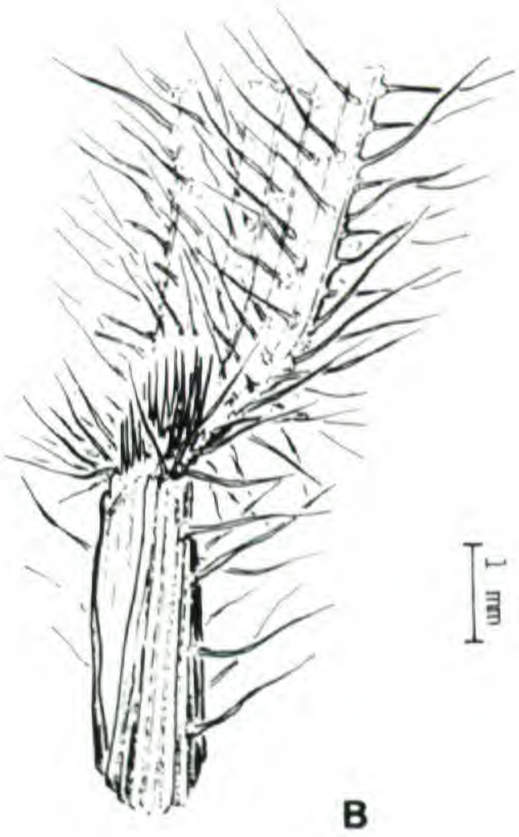
Tufted, delicate annual. Culms 15–36 cm tall, with 4–9 elongated internodes, branching sparingly from the lowermost nodes; internodes hollow, glabrous, stramineous to purplish; nodes papillose-hirsute, dark. Leaves mostly cauline; sheaths rounded on the back, papillose-hirsute with hairs mostly 0.5–1 mm long, the midrib prominent, the margins free; ligule a ciliate membrane, the membrane 0.5–0.8 mm long, the cilia 0.2–0.8 mm long; blades 4–8.2 cm long, 1–2 mm wide, flat, linear, papillose-hirsute, the marginal hairs to 3 mm long, slightly narrowed basally, acuminate apically, the midrib projected abaxially. Inflorescence of 1–2(–4) racemosely arranged, unilateral racemes, solitary from the uppermost leaf sheath; peduncle included to well exserted, glabrous to sparsely pubescent; rachis of the main axis 1.3–2 cm, glabrous to papillose, rarely extending to 3 mm beyond the base of the upper raceme as a naked bristle, with a tuft of hairs at the base of each raceme; racemes 2–6.8 cm long, arcuate, ascending at anthesis, divergent to slightly reflexed at caryopsis maturity, acuminate apically; raceme rachis extending beyond the spikelets to an acuminate apex, prominently winged, the wings 4.5–6 mm wide, completely enclosing the spikelets, the central portion herbaceous, green, inconspicuously nerved, the middle portion membranous, purple, nerveless, the outer portion membranous, colorless, nerveless, abaxially papillose-ciliate, adaxially glabrous, marginally minutely ciliolate; spikelets solitary, alternatively arranged on each side of the rachis, the pedicels 0.1–0.2 mm, puberulent. Spikelets 1.8–2.2 mm long, ca. 0.5 mm wide, dorsally compressed, abaxial, disarticulating below the glume and falling as one unit, narrowly elliptic-lanceolate in outline, awned, with 2 florets; lower glume absent; upper glume 1.8–2.2 mm, as long as the spikelet, hyaline, 3-nerved, somewhat narrowed to the base, convex in the lower ½, flat in the upper ½, densely pubescent on the back in the lower ¼–⅓, otherwise glabrous, the margins ciliate with hairs to 1 mm, the awn 6.0–12.2 mm, minutely antrorsely scaberulous, flexuous, not geniculate; lower floret sterile, consisting only of a lower, awned lemma 1.6–1.9 mm long, slightly longer than the upper floret, hyaline, 3-nerved, flat, densely pubescent on the back in the lower ⅛, otherwise glabrous, the margins ciliate, the awn 0.3–2 mm long, minutely antrorsely scaberulous, flexuous; upper floret 1.5–1.8 mm long, bisexual, slightly coriaceous, pale; upper lemma obscurely 5-nerved, acute, glabrous, smooth but minutely scaberulous along the margins in the upper ¼, the margins slightly inrolled in the upper ⅘; upper palea as long as the upper lemma; lodicules absent; stamens 3, the anthers 1.4–1.9 mm long, initially yellow, becoming purple with age; styles 2, separate; stigmas plumose, initially white, becoming yellowish with age; stamens and styles terminally exserted.











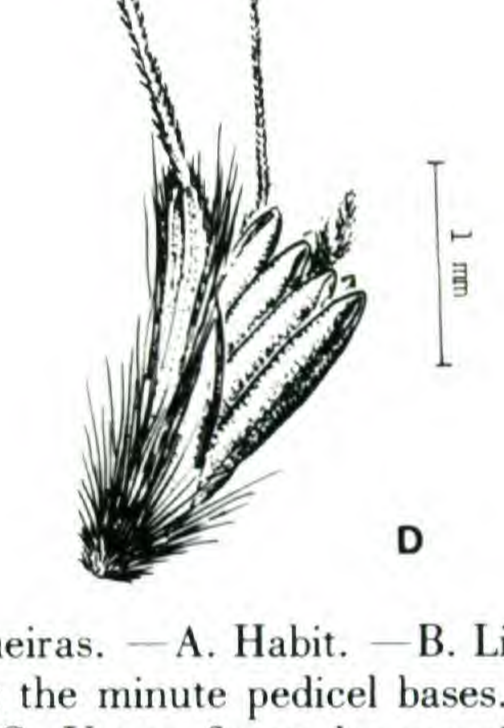


Figure 1. *Paspalum longiaristatum* Davidse & Filgueiras. —A. Habit. —B. Ligular area of the leaf. —C. Portion of the winged rachis with the spikelets fallen, showing the minute pedicel bases. —D. Spikelet at the beginning of anthesis. —E. Upper glume. —F. Lower lemma. —G. Upper floret, lemma side. —H. Upper floret, palea side. (Based on *Brooks et al. 144.*)

Caryopsis 1–1.2 mm; embryo $^{9}/_{10}$–$^{10}/_{10}$ as long as the caryopsis; hilum punctate, basal, ca. $^{3}/_{10}$ as long as the caryopsis.

Paspalum longiaristatum was found growing in huge populations in the campo limpo form of cerrado on serpentine soils. Plants were sampled in two random plots of one square meter each and gave the following results: 93 plants of *P. longiaristatum*, plus 5 plants of 4 other species; and 71 plants of *P. longiaristatum*, plus 4 plants of 4 other species.

The combination of abaxial, plano-convex spikelets, a slightly coriaceous upper lemma with its margins inrolled, broadly winged unilateral racemes, and absence of a lower glume point to a relationship with *Paspalum*.

Paspalum is a genus of about 330 species (Clayton & Renvoize, 1986), none of which have spikelets with awns or even the suggestion of a mucro. The conspicuously awned spikelets of *P. longiaristatum* thus make this a most incongruous species in the genus. For this reason generic status was seriously considered. However, this has not been adopted for the following reasons.

First, awn development is notoriously variable at the generic and higher taxonomic ranks in the family and may sometimes be quite variable within a species. Numerous instances are known of genera with a minority of awned species and a majority of awnless species or vice versa. Some examples of genera in the Paniceae with variable awn development among their species are *Digitaria* Haller, *Echinochloa* P. Beauvois, *Eriochloa* Kunth, *Hymenachne* P. Beauvois, *Melinis* P. Beauvois, *Mesosetum* Steudel, *Panicum* L., *Poecilostachys* Hackel, *Pseudoechinolaena* Stapf, *Rhynchelytrum* Nees, and *Urochloa* P. Beauvois.

Especially notable among these genera are the following two examples: (1) *Panicum aristellum* Doell has shortly awned glumes, the only awned species in a genus of approximately 470 species. Despite a membranous upper lemma, which might suggest a relationship to the genus *Hymenachne*, Zuloaga & Soderstrom (1985) maintained this species in *Panicum*. (2) *Digitaria aristulata* (Steudel) Stapf has an awned lower glume, but in other respects closely resembles other species of *Digitaria*. It is the only awned species in a genus of approximately 230 species. (We here recognize *Digitariella remotigluma* De Winter, an awned species with a strongly developed callus from southern Africa, as belonging in its own monotypic genus, although some recent authors (Clayton & Renvoize, 1986; Gibbs Russell et al., 1990) have merged it into *Digitaria*.)

In the Chloridoideae a similar example is known in *Eragrostis* Wolf, where the Namibian *E. aristata* De Winter is the only awned species in a genus of about 350 species, although there are numerous species with acuminate lemma apices, some of which grade into small awns, such as in *E. dinteri* Stapf. Thus, admitting awned species to otherwise large, awnless genera is not without precedent.

Emphasizing the fact of variability of awn development at another level is that the awn of the lower lemma of *P. longiaristatum* ranges from 0.3 to 2 mm in the same individual.

Second, there is little doubt about the relationship of the new species to the major infrageneric groups of *Paspalum*. The racemosely arranged racemes, the broad, partially purple, membranous rachis wings, the conspicuously hairy, lanceolate spikelets, the upper glume convex in the lower half and flat in the upper half, and the slightly coriaceous, pale upper lemma and palea indicate a close relationship to *Paspalum* subg. *Ceresia*. Although the characters just enumerated do not leave any doubt about its overall relationship with subgenus *Ceresia*, paradoxically this species does not seem closely related to any of the described species and can be immediately distinguished by its annual habit, small, awned spikelets, and the upper glume widest above the middle. No other annual species is known in this subgenus. Although the annual habit of the new species is also distinctive, it, like awn development, is a labile character that has repeatedly and independently evolved in many grass genera.

There is little doubt that if it were not for the prominent awns, this species would be easily accommodated in subgenus *Ceresia*. The single difference is therefore considered to be insufficient to establish a new, monotypic genus. The broader question of whether subgenus *Ceresia* itself deserves generic status is beyond the scope of the present study, but seems eminently worth reconsidering.

Other American genera with racemose inflorescences and broadly winged rachises that were considered in evaluating the relationship of this species include *Mesosetum* and *Thrasya*. *Mesosetum* can be excluded because its spikelets are adaxial with a developed lower glume, and the inflorescences are always solitary racemes (Filgueiras, 1989). *Thrasya* can be excluded because it is characterized by alternately adaxial and abaxial, awnless spikelets borne in one row due to the adnation of the pedicels of the spikelet pairs to the rachis (Burman, 1985).

The lack of functional lodicules seems to be associated with the terminal exsertion of the stamens and stigmas in the new species. This has also been observed in *Paspalum ceresia* (Kuntze) Chase, the type species of subgenus *Ceresia*, although some

specimens seem to have minute (nonfunctional?) lodicules. Other species of the subgenus have normally developed lodicules and terminally or laterally exserted stamens and styles.

At caryopsis maturity, when the leaves are also losing their chlorophyll, each raceme becomes divergent to slightly reflexed. As part of this process, the pulvinus at the base of each raceme twists so that the wing margins point upwards and the midrib of the raceme faces downwards. In this way a narrow, curved, troughlike structure is formed, which holds the spikelets, with the spikelet awns protruding beyond the raceme wings. Presumably this structure is functional in dispersal, but exactly how is not known, although T. Filgueiras observed in the field that the flexuous awns twist together, and because of this the spikelets tend to disarticulate in large groups.

The species name is meant to emphasize the prominently awned upper glume of this species.

Paratypes. BRAZIL. **Goiás:** Macedo, ca. 15 km N of Niquelândia, S-facing hill slope, stable peridotite/dunite-based scree and flat area below, ca. 500–800 m E of nickel workings, campo-cerrado, ca. 1,000 m alt., 14°18′S, 48°23′W, 21 Apr. 1988, *Brooks, Reeves, Baker & Dias Ferreira BRASPEX 144* (MO, NY, SI, UFG); a 18 km de Niquelândia, local chamado Macedo, 10 June 1992, *Filgueiras 2342* (BM, IBGE, ICN, ISC, K, MO, P, SI, SP, UB, US); Niquelândia, 14 Sep. 1991, *Filgueiras 2003* (IBGE, SP).

Acknowledgments. Filgueiras gratefully thanks CAPES (Brazilian Post-Graduation Agency), Brasília, Brazil, for a fellowship that enabled him to work at the Missouri Botanical Garden. He also thanks the Missouri Botanical Garden for making their research facilities available to him. We thank Robert R. Brooks for a duplicate collection, which alerted us to this species. The excellent illustration was made by Vladimiro T. Dudás.

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Murdannia cryptantha (Commelinaceae), a New Species with Cleistogamous Flowers from Australia and Papua New Guinea

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ABSTRACT. *Murdannia cryptantha* (Commelinaceae), a new species from Australia and Papua New Guinea, is described. It is most closely related to *M. graminea*, and it is the first species of *Murdannia* reported to have cleistogamous flowers.

The species of *Murdannia* Royle once were mostly included in the genus *Aneilema* R. Brown (Faden, 1978). Thus, when I attempted to determine the correct generic placement for all epithets in *Aneilema*, I also surveyed the species of *Murdannia* (Faden, 1991). In the course of that investigation I came upon slender plants of a *Murdannia* species from northern Queensland, Australia, that generally resembled the widespread species *M. graminea* (R. Brown) G. Brueckner except for the presence of sessile, axillary flowers and capsules, in addition to terminal inflorescences and infructescences. It was not until I obtained living material (*A. Faden 2/91*) that I was able to confirm that such plants represent a distinct species.

Murdannia cryptantha Faden, sp. nov. TYPE: Australia. Queensland. Port Curtis Dist.: road from Rockhampton to Emerald, 3 km beyond Gogango, fenced area across railway line, brigalow bushed-grassland with frequent small temporary water holes, edge of temporary pools, 3 Mar. 1991, *A. J. Faden 2/91* (holotype, US; isotypes, K, BRI). Figures 1–2.

Herba perennis foliis omnibus caulinibus 1.5–7(–13) cm longis, 1.5–5.5 mm latis, thyrso terminali et floribus axillaribus sessilibus vel subsessilibus cleistogamis, capsulis (5–)6–10(–12) mm longis, ca. 2 mm crassis, loculis (4–)6–8(–15)-seminalibus, seminibus 0.6–0.9(–1.1) mm latis.

Perennial with thickened, sometimes fusiform roots to 3 mm thick. Shoots erect to ascending, often rooting at the lower nodes, to ca. 35 cm long, unbranched or sparsely branched basally. Internodes 2–7 cm long, glabrous to pubescent, sometimes the pubescence confined to a longitudinal line. Leaves all cauline, distichous or in an open spiral; sheaths 0.5–2 cm long, often splitting to the base, ciliate or ciliolate at the apex and along the fused edge, sheath surface glabrous or pubescent; lamina sessile, linear-lanceolate, decreasing in length distally on the flowering shoot, conduplicate or planar, often recurved at the apex, 1.5–7(–13) cm long, 1.5–5.5 mm wide, with base rounded to somewhat amplexicaul and apex acuminate to acute, margins undulate or planar, ciliate or ciliolate at the base of the lamina, sometimes scabrid at the apex, otherwise glabrous, both surfaces of the lamina glabrous to sparsely pubescent, sometimes only the abaxial surface pubescent.

Inflorescences axillary and terminal, glabrous, the axillary enclosed within a leaf sheath and consisting of a single sessile, bracteolate cincinnus that produces 1–4 sessile or subsessile cleistogamous flowers, the terminal inflorescence a lax thyrse consisting of 1–4 cincinni, each cincinnus to 4 cm long and producing up to 8 chasmogamous flowers. Bracts of the cincinni of the terminal inflorescences linear to ovate-lanceolate, 1–9 mm long; bracteoles of the terminal inflorescences ovate to lanceolate-elliptic, 0.7–2.5 mm long.

Flowers all bisexual or an occasional chasmogamous one staminate. Chasmogamous flowers slightly zygomorphic; pedicels erect, 4–8.5 mm long in flower, to 9 mm long in fruit, glabrous. Sepals subequal, boat-shaped, elliptic to oblong-elliptic, 3–7 mm long in flower, to 8 mm long in fruit, glabrous. Petals subequal, not clawed, ovate to suborbicular, 5–9 mm long, pale purple to mauve or lavender, glabrous. Filaments of stamens and staminodes free. Stamens antesepalous, equal but all bending to one side of the flower, filaments bending outwards near the middle, 2.5–4 mm long, densely bearded with moniliform hairs below the middle, anthers dorsifixed, elliptic or oblong-elliptic, 1–2 mm long. Staminodes antepetalous, symmetrically arranged, filaments shorter and more slender than those of the stamens, densely bearded below the middle, antherodes basifixed, 0.5–0.7 mm long, usually ovate with a cordate base, yellow. Ovary sessile, trigonous, 2–2.5 mm long, trilocular, glabrous, locules up to 13-ovulate, ovules uniseriate, style bent away from

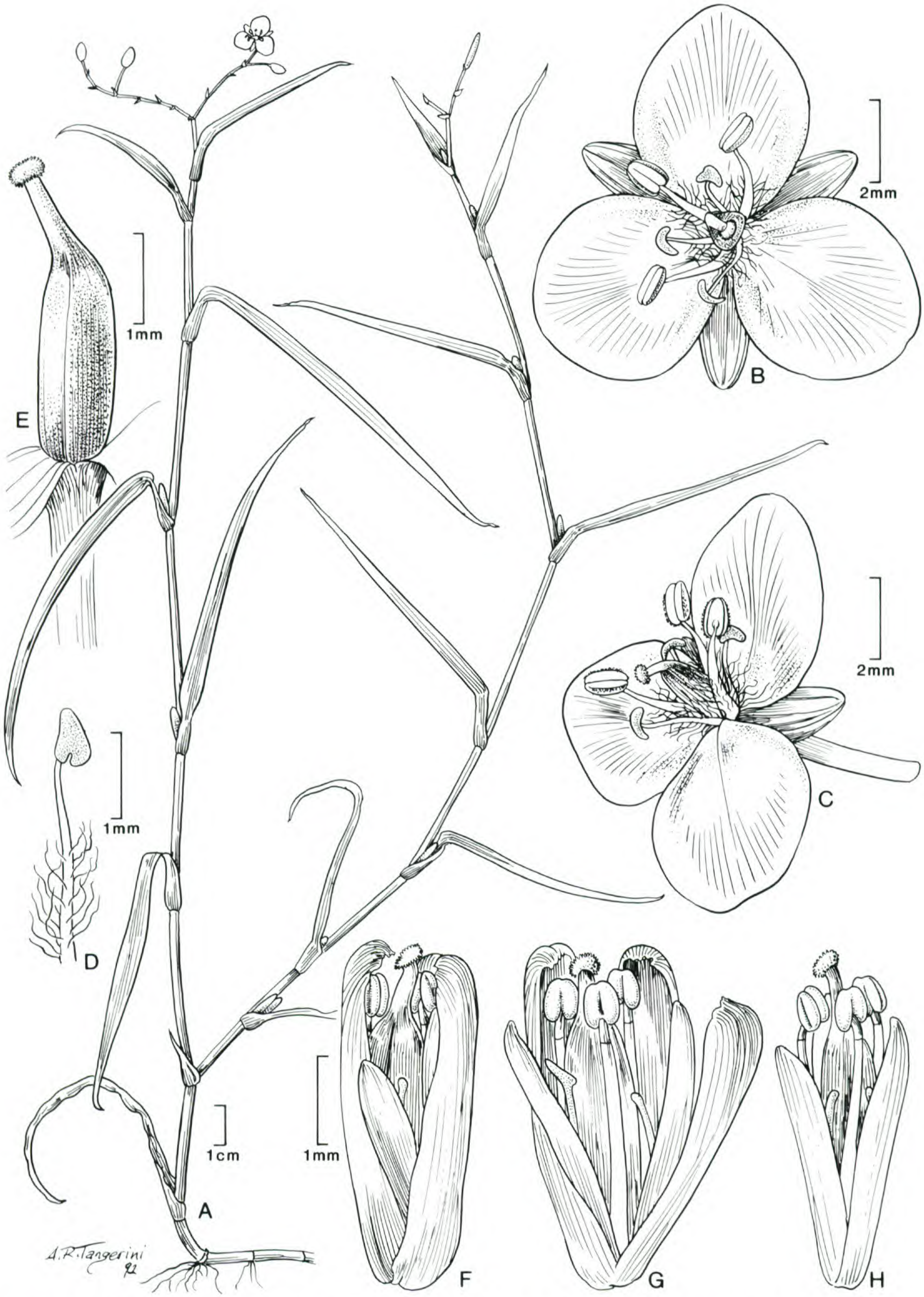

Figure 1. *Murdannia cryptantha* Faden. —A. Partial habit. —B. Chasmogamous flower, front view. —C. Chasmogamous flower, front/side view. —D. Staminode. —E. Gynoecium. —F. Cleistogamous flower, slightly opened. —G. Cleistogamous flower, front sepal and two petals pulled back. —H. Cleistogamous flower, sepals removed. All from *A. Faden 2/91* except inflorescence on left shoot in A added from *Brass 18709* (GH).

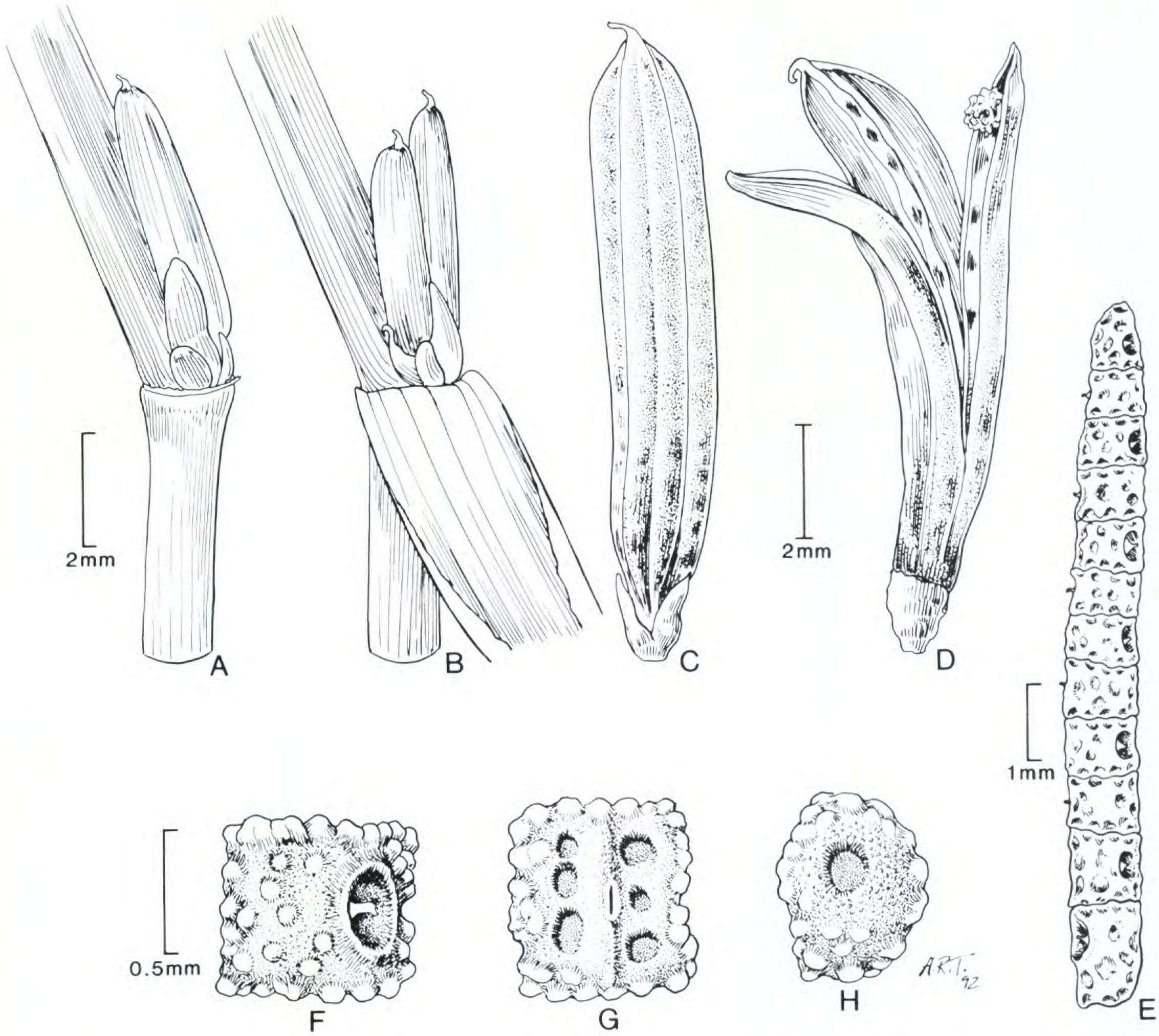

Figure 2. *Murdannia cryptantha* Faden. —A. Mature capsule and bud in axillary inflorescence. —B. Mature capsules from cleistogamous flowers in axillary inflorescence. —C. Mature capsule from cleistogamous flower, before dehiscence. —D. Capsule from cleistogamous flower, dehisced. —E. All of the seeds from a single capsule locule, showing arrangement in locule. —F. Seed, dorsal view. —G. Seed, ventral view, showing hilum on raised ridge. —H. Seed, apical view. All from *A. Faden 2/91.*

the stamens, straight, 1–1.5 mm long, stigma capitate. Cleistogamous flowers sessile, difficult to differentiate from large buds, on the one hand, and young, developing fruits, on the other hand. Sepals oblong-elliptic, 3.5–4 mm long, glabrous. Petals elliptic to oblong-elliptic, 2.5–2.8 mm long, 0.7–1 mm wide. Filaments of stamens and staminodes free. Stamens subequal, filaments ca. 2–2.5 mm long, glabrous, jointed just below a swollen summit, anthers apparently dorsifixed, elliptic, ca. 0.5–0.7 mm long, dehiscence introrse. Staminodes variable in form, filaments ca. 1.1–1.3 mm long, very slender, glabrous, antherode minute, oblong to ovate, irregularly lobed or unlobed. Ovary sessile, ca. 2.5 mm long, trilocular, locules up to 15-ovulate, ovules uniseriate or partially biseriate, style ca. 0.5 mm long, stigma capitate.

Capsules trilocular, trivalved, dehiscent at least at the apex, cylindric-trigonal, apiculate, (5–)6–10 (–12) mm long, ca. 2 mm thick, usually dark brown at maturity, glabrous, cells of the outer wall transversely elongate, locules (4–)6–8(–15)-seeded, seeds uniseriate. Seeds very variable in size, often within the same locule, rectangular to trapezoidal, rarely triangular in outline, the apical and basal seeds rounded on one end, (0.35–)0.6–1.5(–1.75) mm long, 0.6–0.9(–1.1) mm wide, testa brown to gray, rugose or verrucose and variously pitted, often farinose in the depressions and around the embryotega, hilum punctiform to elliptic, often on a raised longitudinal ridge, embryotega ± lateral.

Distribution. Northern Queensland and northern Northern Territory, Australia to Papua New Guinea.

Murdannia cryptantha is undoubtedly most closely related to the very variable *M. graminea* because of its geophytic habit, thyrsiform inflorescence, bearded stamen and staminode filaments, and several-seeded capsule locules. *Murdannia cryptantha* can be distinguished by the presence of axillary, sessile or subsessile, cleistogamous flowers and capsules, and by its narrower capsules (2.5–4 mm thick in *M. graminea*), more numerous seeds per locule (2–5 per locule in *M. graminea*), and smaller seeds (1.2–3.9 mm long, 0.9–2 mm wide in *M. graminea*). It further differs by the absence of basal leaves (present in many specimens of *M. graminea*) and by the usually smaller leaves and terminal thyrses. In our present state of knowledge, specimens of *M. cryptantha* that lack fruits or cleistogamous flowers might not be separable from certain small plants of *M. graminea* unless characters such as style length (shorter than the ovary in *M. cryptantha* and longer (always?) than the ovary in *M. graminea*) prove to be consistent and other floral differences are found.

Murdannia cryptantha is the first in this genus of approximately 50 species to be recorded as having cleistogamous flowers. The best known examples of cleistogamy in the Commelinaceae are in *Commelina benghalensis* L. and *C. forskaolii* Vahl (see Faden, 1993).

In the above descriptions it should be noted that, following Faden (1991: 42), seed length is the distance between the apical and basal surfaces, i.e., the dimension parallel to the capsule length, and seed width is the distance between the lateral surfaces, i.e., transverse to the locule.

Paratypes. AUSTRALIA. Queensland. **Cook Dist.:** Douglas Creek, ca. 7 mi. SE of Mareeba, open forest on a stony ridge, 9 Apr. 1967, *Brass 33523* (BRI); Lockerbie, 10 mi. WSW of Somerset, alt. 30 m, wet teatree flat, 22 Apr. 1948, *Brass 18361* (CANB, GH); Cape York Peninsula, Newcastle Bay, 2.5 mi. S of Somerset, alt. 50 m, wallum scrub in hollow between coastal sand dunes, 9 May 1948, *Brass 18709* (CANB, GH); Mt. Molloy, moist flats, Jan.–Apr. 1941, *Carr 195* [*in Flecker Herbarium 7473*], *Carr 206* [*in Flecker Herbarium 7484*], *Carr 207* [*in Flecker Herbarium 7485*] (all on one sheet) (QRS); near Mareeba, poorly drained soil with sandy surface in *Eucalyptus polycarpa–E. leptophleba* community, 23 Apr. 1967, *Pedley 2276* (BRI); near Mareeba, layered woodland with *E. alba*, *E. leptophleba*, and *Melaleuca minutifolia*, 27 Feb. 1962, *Webb & Tracey 5879* (BRI—3 sheets); Cairns, [collector illegible] (BRI#155853). **Darling Downs Dist.:** "Woodlands" 5 mi. SW of Westmar, gray clay soil in cleared brigalow, 14 Dec. 1961, *Pedley 925* (BRI). **Northern Territory:** Arnhem Land Aboriginal Reserve, South Bay, Bickerton Island in the Gulf of Carpentaria, 13°45′S, 136°06′E, moist *Melaleuca leucodendra* stand, 11 June 1948, *Specht 531* (BRI, CANB, US). PAPUA NEW GUINEA. **Central Dist.:** Rubulogo Creek, ca. 18 mi. N of Port Moresby, alt. ca. 140 ft., *Eucalyptus* savannah land, 12 Apr. 1967, *Pullen 6688A* (CANB; other duplicates cited but not seen: A, BRI, E, K, L, LAE).

Acknowledgments. I thank the directors of the herbaria cited for the loan of specimens; an anonymous reviewer for helpful comments; Alice Tangerini for the illustrations; and my wife, Audrey J. Faden, for collecting the new species and maintaining my research plants for many years.

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Six New Species of *Adenocalymna* (Bignoniaceae) from Eastern South America

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ABSTRACT. Six new species of *Adenocalymna* are described from Brazil and French Guiana.

Adenocalymna is one of the genera of Bignoniaceae tribe Bignonieae that is most prone to local endemism (Sutherland, 1983). Six new species of the genus are included in recent collections from eastern South America.

Adenocalymna dichilum A. Gentry, sp. nov. TYPE: Brazil. Piauhy: Bom Jesus–São Raimundo Nonato, caatinga, 11 May 1979 (fl), *A. Fernandes s.n. (EAC 6185)*, (holotype, EAC; isotype, MO).

Frutex scandens, ramulis teretibus. Folia 2(–3?)-foliolata, interdum cirrho simplici, foliolis ovatis vel ellipticis, infra valde villosis. Inflorescentia floribus in racemo terminali dispositis. Calyx cupulatus, 5-dentatus, 12–14 mm longus; corolla lutea, valde bilabiata, extus puberula. Capsula ignota.

Liana; branchlets terete, longitudinally striate, with scattered small inconspicuous lenticels, finely puberulous with small suberect whitish trichomes; pseudostipules ovate, 3–4 mm long; interpetiolar glandular fields absent. Leaves 2(–3?)-foliolate, the terminal leaflet sometimes replaced by a simple tendril, the leaflets ovate to elliptic, obtuse to emarginate at apex, rounded to distinctly cordate at base, 2–4 cm long, 1.5–3.5 cm wide, above ± glabrescently puberulous with short erect trichomes, below persistently villous, coriaceous, drying brownish above, olive below, the tertiary venation prominulous below, finer venation obscured by the indumentum; petiole 1.5–2.5 cm long, petiolules 0.2–0.9 cm long, rather densely tomentose with multicelled trichomes. Inflorescence a terminal raceme, densely tannish tomentose, with pair of caducous obovate coriaceous bracts ca. 1.5 cm long subtending each node, each bract with several large plate-shaped glands, the pedicels 1–1.5 cm long, with pair of ca. 1-cm-long elliptic bracteoles near apex subtending calyx. Flowers with the calyx cupular, shallowly 5-dentate, 12–14 mm long, 9–10 mm wide, tannish puberulous, with conspicuous plate-shaped glands near margin; corolla yellow, ± tubular, strongly bilabiately split almost to middle, ca. 3.5 cm long, ca. 1 cm wide at mouth of tube, the tube ca. 1.8 cm to base of split, the lower lobes narrow, ca. 1 cm long, the upper two lobes with free part ca. 3 mm long but basally fused to form 1.5-cm-long upper lip, densely puberulous outside except for base of tube; stamens subexserted, the thecae subparallel, pendulous, ca. 6 mm long; pistil and disk not examined. Fruit not seen.

Distribution. Known only from the type from the caatinga of northeastern Brazil.

This species is most similar to *A. bracteatum* (Chamisso) DC. in its large bracts and coriaceous, densely puberulous calyx and keys out with that species in *Flora Brasiliensis* (Bureau & K. Schumann, 1896–1897). The most striking difference from *A. bracteatum* is in the deeply bilabiately split corolla that looks more like an overgrown *Tynanthus* flower than like that of other species of *Adenocalymna*. Curiously, several quite unrelated species of Bignoniaceae share this unusual floral morphology in northeastern Brazil. In addition to *A. dichilum*, they are *Arrabidaea tynanthoides* A. Gentry, and *Arrabidaea crassa* Sprague (not closely related to each other), and to a lesser extent, *Mansoa ventricosa* A. Gentry.

Adenocalymna fruticosum A. Gentry, sp. nov. TYPE: Brazil. Bahia: Serra do Sincora, 6 km N of Cascavel on road to Mucugé, alt. 1,200 m, 41°25′W, 13°6′S, 25 Mar. 1980 (fl), *R. M. Harley, G. L. Bromley, A. M. de Carvalho & G. Martinelli 29043* (holotype, CEPEC; isotypes, K not seen, MO).

Suffrutex, ramulis teretibus. Folia 2–3-foliolata, ecirrhata, foliolis ovalibus vel subrotundatis, glabris. Inflorescentia floribus in racemo terminali dispositis, pedicellis bracteis 1–1.5 cm longis subtentis. Calyx campanulatus, minute 5-denticulatus, 8–11 mm longus; corolla lutea pallida, tubulo-campanulata, tubo extus glabro. Capsula ignota.

Spindly shrub to 1 m tall; branchlets terete, longitudinally striate-ridged, sparsely minutely puberulous; pseudostipules subulate, ca. 1 mm long, in-

terpetiolar glandular fields lacking, a ridge connecting the opposite petiole pairs. Leaves 2–3-foliolate, without tendrils, the leaflets oval to almost suborbicular, rounded to truncate or emarginate at base and apex, 3–5.5 cm long, 2.3–4 cm wide, completely glabrous, the lower surface appearing somewhat glandular lepidote, coriaceous, drying olive, the venation raised above and below, the margin cartilaginous; petioles 1–3 cm long, the petiolules mostly very short, 0.1–1 cm long, glabrous except for a few tiny lepidote trichomes on flattened upper surface. Inflorescence a terminal raceme, minutely puberulous with simple and thick-stellate trichomes, with a pair of olive-drying longitudinally ribbed foliaceous bracts 1–1.5 cm long subtending each pair of pedicels, the pedicels ca. 5 mm long, densely dendroid puberulous, with a pair of ca. 1-mm-long bracteoles near base. Flowers with the calyx campanulate, truncate, minutely 5-denticulate, 8–11 mm long, 8–11 mm wide, densely minutely tannish puberulous with dendroid trichomes, also with dark-drying glandular areas; corolla (only 1 seen) creamy yellow, tubular-campanulate, 5 cm long, 1.2 cm wide at mouth of tube, the tube 4 cm long, the lobes 1 cm long, the tube glabrous, the lobes densely capitate-glandular; stamens included; pistil 3.5 cm long, the ovary oblong, 2 mm long, 1 mm wide, glandular surfaced; disk thick-pulvinate, 1.5 mm long, 3 mm wide. Fruit not seen.

Distribution. Known only from the type collected in "campo geral" grassland rich in dicot herbs and shrubs and acaulous palms.

This species is unusual in the genus in having an erect shrubby habit. Although there are a few erect species of *Adenocalymna* in the forest understory of coastal Brazil, this is the first member of its genus known to adopt the characteristic suffrutescent form so typical of the plants of the open cerrado and allied vegetations. *Adenocalymna fruticosum* is related to *A. apparicianum* J. C. Gomes by its similar calyx, but that species differs in lacking persistent foliaceous bracts, climbing habit, and different leaves with a very different dull rough-reticulate texture and trichomes on the undersurface. *Adenocalymna apparicianum* occurs further north in the caatinga of Ceara and Rio Grande do Norte.

Adenocalymna gracielzae A. Gentry, sp. nov. TYPE: Brazil. Pará: Senador Jose Porfirio (Sozel), Rio Xingu, 3 Dec. 1991 (fl), *G. dos Santos, N. A. Rosa & M. R. dos Santos 276* (holotype, MG; isotypes, MO, MAD).

Frutex scandens, ramulis teretibus, minute puberulis. Folia 2–3-foliolata, interdum cirrho simplici, foliolis ellipticis vel anguste ellipticis, infra sparsim puberulis saltem costa. Inflorescentia floribus in racemo terminali dispositis. Calyx cupulatus, minute 5-denticulatus, 3–6 mm longus; corolla lutea vel cremosa, anguste tubulo-campanulata, extus puberula. Capsula oblonga, haud compressa, valvis valde bialatis, puberulis, seminibus non alatis.

Liana, the branchlets terete, minutely puberulous with small erect trichomes, at length glabrescent, inconspicuously striate, drying brown, with minute lenticels when older, the pseudostipules blunt-conical, 2–3 mm long. Leaves 3-foliolate or 2-foliolate with a simple tendril or tendril scar, the leaflets elliptic to narrowly elliptic, obtuse to acuminate, the base rounded, 3–21 cm long, 1.5–8.5 cm wide, chartaceous to subcoriaceous, main veins ± plane above, noticeably raised below, veinlets very slightly raised above and below, drying olive to olive brown above, yellowish olive to grayish olive below, usually rather shiny and varnish-surfaced, especially above, glandular-lepidote above and below, above glabrous except for short crisped trichomes on midvein, below puberulous with short crisped trichomes at least scattered along base of main veins and sometimes sparsely over surface; petiolules 0.5–2.5 cm long, petiole 1–4 cm long, puberulous. Inflorescence a contracted terminal raceme, densely puberulous, drying tannish, a pair of small early caducous lanceolate bracts 1–2 mm long subtending each pair of pedicels in young bud, the pedicels 3–5 mm long, each with a pair of small caducous 1–2 mm long triangular bracteoles near its base, the bracteoles puberulous and sometimes glandular. Flowers with the calyx cupular, minutely 5-denticulate, 3–6 mm long, 3–5 mm wide, finely and uniformly puberulous, with a few conspicuous scattered raised hollow-centered, pustulelike glands; corolla yellow to greenish cream, tubular-campanulate above a 2–3-cm-long narrowly tubular base, 5–7 cm long, 1–1.3 cm wide at mouth of tube, the tube 3.5–6 cm long, the lobes 0.5–1 cm long, the lobes and tube outside puberulous with thick-stellate trichomes, the tube outside also with conspicuous glands at base of lobes, inside glandular villous at level of stamen insertion; stamens didynamous, inserted 25–30 mm from base of corolla tube, the anthers included or the longest pair subexserted, the thecae divergent to subparallel, 4–5 mm long, the staminode ca. 7 mm long; pistil 5–5.5 cm long, the ovary linear with conspicuously raised angles, 3–4 mm long, < 1 mm wide, glabrous, becoming densely puberulous with glandular angles in young fruit; disk annular-pulvinate, 1.5 mm long, 1.5–2 mm wide. Capsule oblong or oblong-ellipsoid, not at all compressed, the valves woody, with pair of prominent thick wings along each valve, the fruit thus somewhat tetragonal in cross section, 10–18

cm long, 5–7 cm thick and wide (including wings), drying light grayish, the midrib not visible, densely minutely puberulous, the surface slightly wrinkled-striate, the wrinkles making an acute angle with axis of fruit; seeds thick and wingless, 2–3 cm long, 2–3.5 cm wide.

Distribution. Restricted to the margins of the Rio Xingu and its tributaries, where it mostly occurs in restingas or riverside scrub forest.

This species is closely related to *A. purpurascens* Rusby, which is widespread in Amazonia, and to *A. divaricatum* Miers, which occurs in the caatinga and deciduous forest of eastern Brazil. These are the only other *Adenocalymna* species to have the distinctive winged fruit that characterizes the new species. *Adenocalymna gracielzae* differs dramatically from these species in the thick wingless seeds, presumably representing a water-dispersed derivative of one of these widespread wind-dispersed species. It also differs in the unusual flower shape with a relatively long narrow corolla having the narrow basal part of the tube much elongated. It is likely that *A. gracielzae* represents incipient hawkmoth pollination in this otherwise mostly bee-pollinated genus.

Paratypes. BRAZIL. **Pará:** Porto de Moz, Rio Acai, 2 Dec. 1991 (fl), *G. dos Santos, N. A. Rosa & M. dos Santos 260* (MG, MO), 2 Dec. 1991 (fr), *G. dos Santos et al. 260* (MG, MO), 2 Dec. 1991 (st), *G. dos Santos et al. 261* (MG, MO); Senador Jose Porfirio (Sozel), Rio Xingu, 3 Dec. 1991 (fr), *G. dos Santos et al. 280* (MG, MO), 5 Dec. 1991 (fl), *G. dos Santos et al. 311* (MG, MO); Parauapebas, Reserva Biologica da Serra dos Carajas, 650 m, 21 Nov. 1991 (st), *G. dos Santos et al. 199* (MG, MO), 21 Nov. 1991 (fr), *G. dos Santos et al. 200* (MG, MO).

Adenocalymna hatschbachii A. Gentry, sp. nov. TYPE: Brazil. Paraná: Morro do Arrastão, Municipio Morretes, mata pluvial encosta de morro, 200 m, 18 July 1981 (fl), *Hatschbach 43956* (holotype, MO; isotype, MBM).

Frutex scandens, ramulis teretibus, minute puberulis. Folia 2–3-foliolata, interdum cirrho simplici, foliolis lanceolatis vel elliptico-lanceolatis, membranaceis, plerumque fere glabris. Inflorescentia floribus in racemo axillari dispositis. Calyx campanulatus, 5-dentatus, 8–12 mm longus; corolla lutea, tubulo-campanulata, extus puberula; stamina subexserta. Capsula anguste oblonga, haud compressa, puberula, seminibus non alatis.

Liana (rarely treelet?), the branchlets terete, sparsely to densely minutely puberulous with crisped trichomes, not obviously lenticellate, longitudinally minutely striate, the pseudostipules subulate, to 5 mm long. Leaves 3-foliolate or 2-foliolate with an unbranched terminal tendril or tendril scar, the leaflets lanceolate to lanceolate-elliptic, long acuminate, broadly cuneate to rounded at base, 3–17 cm long, l0.8–4.5 cm wide, membranaceous, drying gray-green with the venation light tannish below, the tertiary venation prominulously raised above and below, glabrous below or with a few trichomes at base of midvein or scattered along main veins, above puberulous along midvein; petiole 0.8–6 cm long, puberulous, the petiolules 0.3–4.5 cm long. Inflorescence an axillary or apparently terminal raceme, finely puberulous with whitish trichomes, the bracts caducous, linear to narrowly lanceolate, eglandular, to 1.5 cm long, the bracteoles linear, mostly ca. 0.5 cm long. Flowers with the calyx campanulate, shallowly and broadly 5-dentate, 8–12 mm long, 5–10 mm wide, densely minutely puberulous, drying tannish to brownish, thin and eglandular or with few inconspicuous glands; corolla yellow, tubular-campanulate above the 1–1.5-cm-long basal tube, 5–6.5 cm long, 1–2 cm wide at mouth of tube, the lobes ca. 1 cm long, the tube 4.5–5.5 cm long, rather densely minutely puberulous outside and on lobes inside, villous with long multicellular trichomes at level of stamen insertion; stamens didynamous, the anthers divaricate, 4–5 mm long, at least the longest pair exserted or subexserted; pistil with the ovary narrowly oblong, strongly tetragonal with raised angles, 4–5 mm long, ca. 1 mm wide, glabrous; disk pulvinate-patelliform, 1 mm long, 2–3 mm wide. Fruit narrowly oblong, the valves woody, strongly convex, 9–17 cm long, 3.5–4.5 cm wide, finely tannish puberulous, the surface usually minutely longitudinally striate, also with a few irregular widely scattered warty projections; seeds thick, wingless, 1.5–2 cm long, 2–2.5 cm wide.

Distribution. Restricted to the wet subtropical forests of southern coastal Brazil, occurring near sea level from Paraná to southern São Paulo, and perhaps north to Rio de Janeiro at higher altitudes.

This species is most closely related to *A. dusenii* Kränzlin, which has similar thin calyces and pale intricately prominulous venation on the leaf undersurface, but differs in larger bracts and bracteoles, usual presence of conspicuous calyx glands, thicker distinctly coriaceous leaves, and the corolla more infundibuliform-campanulate with included anthers. It is also closely related to *A. comosum* (Chamisso) DC., and the Neuwied collection, consisting of a single leaflet and flower, was identified as "*Adenocalymma* spec. fors *comosum* var. *lanceolata*" (after an original determination with an unpublished name "Bignonia divergens"). *Adenocalymna hatschbachii* differs from *A. comosum* in the much narrower long-acuminate membranaceous leaflets

with a very different less prominulous-veined surface texture.

The Brade collection from Rio de Janeiro was identified by Laroche as *A. guilleminii* (i.e., *A. grandifolium* var. *guilleminii*), a taxon that is vegetatively rather similar but has a completely different, much larger and thicker calyx. This specimen, which has thicker calyces, nonexserted anthers, and was described as a 3-m treelet, may not be conspecific with the material from Paraná.

One specimen that may be referable to this species is not included in the above description. This is *Hatschbach 19251* (MBM, MO) from Rio Cambara, Mun. Paranagua, Paraná, 50 m elev., which differs in more long-exserted anthers and more elliptic leaflets. It is possible that the corolla is also somewhat more zygomorphic than in typical *A. hatschbachii*. Whether this collection represents an extreme form of *A. hatschbachii* or a closely related, undescribed taxon cannot be determined without additional material.

Paratypes. BRAZIL. **Paraná:** Reserva Biologica de Sapitanduva, Mun. Antonina, 40 m, 25°30′S, 48°45′W, 24 Jan. 1985 (fr), *Gentry & Zardini 49788* (MBM, MO), 4 Apr. 1982 (fl), *Hatschbach 45193* (MO); Rio Canavieiras, Mun. Guaratuba, 20–50 m, 21 July 1987 (fl), *Hatschbach & Cordeiro 51271*, 2 Oct. 1986 (fr), *Silva & Cervi 193* (MBM, MO); Rio Brumado, Mun. Morretes, 4 July 1984 (fl), *Hatschbach 48076* (MBM, MO). **Rio de Janeiro:** Angra dos Reis, Serra do Mar, 600 m, 29 June 1935 (fl), *Brade 14910* (B, MO, RB); sin. loc. "Brasilia," *Neuwied 479* (P). **São Paulo:** Sete Barras, S entrance to Carlos Botelho State Park, 70 m, 46°55′W, 24°22′S, 4 Sep. 1987 (st), *Gentry, Dias & Franco 59037* (MO, SPF).

Adenocalymna saulense A. Gentry, sp. nov. TYPE: French Guiana. Saül, 3°37′N, 53°12′W, between Carbet and "steep, mean hill," 250–350 m, 27 Aug. 1988 (fl), *Mori et al.* (10 collectors) *19192* (holotype, MO; isotypes, CAY, NY not seen).

Frutex scandens, ramulis teretibus. Folia 2–3-foliolata, interdum cirrho simplici, foliolis ellipticis vel oblongo-ellipticis, coriaceis, infra valde aspris. Inflorescentia floribus in racemo ramifloro dispositis. Calyx campanulatus, 2–3-labiatus, 8–10 mm longus; corolla alba, tubo extus glabra, lobis puberulis. Capsula ignota.

Liana, the branchlets terete, minutely puberulous, conspicuously swollen at nodes. Leaves 3-foliolate or 2-foliolate with a terminal tendril or tendril scar, the leaflets elliptic to oblong-elliptic, obtuse to acutish at apex, rounded to truncate at base, 7–17 cm long, 3–7.7 cm wide, coriaceous, drying gray above, gray to gray-green below, glabrous above or with a very few minute trichomes at base of midvein, below strongly asperous from the scattered very short suberect trichomes, these occasionally in part forked; petiole 2–3 cm long, the petiolules 1–3 cm long, puberulous with minute erect trichomes, distinctly subwoody. Inflorescence a ramiflorous raceme (7-flowered in type), finely grayish puberulous with a mixture of simple and stellate trichomes, each pedicel subtended by a minute bract < 1 mm long, bracteoles absent. Flowers with the calyx campanulate, irregularly 2–3-labiate, 8–10 mm long, 5–7 mm wide, densely minutely puberulous with mixture of stellate and simple trichomes, drying grayish with few striking, large (nearly 1 mm long), black elliptic glands near middle; corolla white, yellow in bud, tubular (?, only in bud in holotype), the tube glabrous except toward apex, tube apex and lobes puberulous outside; ovary oblong, ± tetragonal, 2.5 mm long, 1 mm wide, the surface papillate; disk destroyed in only flower dissected. Fruit unknown.

Distribution. Known only from the Saül area of French Guiana (see Mori, 1987) where it occurs in well-drained moist forest on lateritic soil.

This species is well-marked vegetatively by the strikingly scabrous leaflet undersurface, and in flower by the reduced bracts, absence of bracteoles, and the unusually large plate-shaped glands on the irregularly bilabiate gray-drying calyx. Its closest relatives are *A. prancei* A. Gentry and *A. subincanum* Huber, which have nonasperous leaves with the venation more raised-reticulate below and tan-drying, 5-denticulate calyces with much smaller glands. Another noteworthy character of *A. saulense* is the strongly swollen woody nodes and subwoody strongly articulated petioles and petiolules. The material available to me has only buds and calyces of fallen flowers, so the corollas at anthesis cannot be described.

Paratype. FRENCH GUIANA: **Saül,** second growth near airport, 220 m, 24 June 1988 (st), *Gentry 63176* (CAY, MO).

Adenocalymna subspicatum A. Gentry, sp. nov. TYPE: Brazil. Ceará: Sitio Para, Viçosa do Ceara, carrasco, 14 June 1979 (fl), *A. Fernandes, P. Martins & Matos s.n. (EAC 6501)*, (holotype, EAC; isotype, MO).

Frutex scandens, ramulis teretibus, minute puberulis. Folia 2–3-foliolata, interdum cirrho simplici, foliolis lanceolatis vel anguste ovatis, chartaceis vel subcoriaceis, plerumque fere glabris. Inflorescentia floribus in racemo subspicato terminali dispositis, pedicellis 0.1–0.3 cm longis, bracteis 1.5–2.5 cm longis subtentis. Calyx tubulo-campanulatus, 5-dentatus, 9–14 mm longus; corolla extus alba, intra lutea, tubulo-infundibuliformis, extus puberula. Capsula ignota.

Liana, the branchlets terete, distinctly longitudinally ridged, glabrous to minutely puberulous with crisped trichomes, pseudostipules subulate, tan, 2–4 mm long. Leaves 3-foliolate or 2-foliolate with a simple tendril, the leaflets lanceolate to narrowly ovate, acute to acuminate but with the apex ultimately minutely emarginate, the base usually asymmetric, rounded to truncate or subcordate on one side, 2.5–10 cm long, 1–3.5 cm wide, chartaceous to subcoriaceous, scattered lepidote-glandular above and below, ± inconspicuously and minutely puberulous along midvein above and/or below, otherwise glabrous, drying olive above and below, the venation not prominently raised, the margin inconspicuously and minutely cartilaginous; petiole 0.7–2.5 cm long, petiolules 0.3–1.4 cm long, flattened above, sparsely lepidote and puberulous, especially above. Inflorescence a very narrow terminal raceme, sparsely to conspicuously lepidote and puberulous with rather long bent trichomes, the bracts foliaceous, membranaceous, lanceolate, mostly 1.5–2.5 cm long, 6–8 mm wide, ± puberulous, essentially reduced leaves and occasionally ± trifid, the pedicels 0.1–0.3 cm long, usually with pair of thin 1–1.5-cm-long bracteoles near middle. Flowers with the calyx tubular-campanulate, broadly and shallowly 5-dentate, 9–14 mm long, 5–6 mm wide, minutely and rather sparsely puberulous, the margin more densely puberulous and whitish, prominently 5-ribbed; corolla white outside, yellow inside, tubular-infundibuliform, 5–6 cm long, 1.2–1.5 cm wide at mouth of tube, the tube 4–5 cm long, the lobes ca. 1.5 cm long, puberulous outside with multicellular kinky trichomes, the lobes densely ciliate, lobes inside glandular-lepidote, tube mostly glabrous inside except at level of stamen insertion; anther thecae divaricate, 3–4 mm long; ovary cylindric, 2.3 mm long, ca. 0.8 mm wide, minutely lepidote; disk patelliform, 1 mm long, 2–3 mm wide. Fruit unknown.

Distribution. Apparently endemic to the "carrasco" vegetation of the caatinga region of northeast Brazil.

The outstanding feature of this species is its long, rather thin, tubular calyx with five prominent longitudinal ribs. Despite its large bracts, this species is probably most closely related to *A. divaricatum* Miers, which has similar branchlets and pseudostipules, but differs in having minute inconspicuous inflorescence bracts, a shorter, thicker, dark-drying unridged calyx, usually longer pedicels, yellow corolla, and the leaflets prominulously reticulate beneath. *Adenocalymna divaricatum* occurs further east in the caatinga and dry habitats nearer the coast. *Adenocalymna subspicatum* occurs in the transition zone between the dry caatinga vegetation and easternmost Amazonian forests. Vegetatively, *A. subspicatum* is also reminiscent of *A. flavum* in the color and texture of its leaves and bracts, but that species has a much smaller, nonribbed calyx.

Paratypes. BRAZIL. **Maranhão:** Km 380–375, Belem–Brasilia, beira da estrada, terra firme, 28 Aug. 1960 (fl), *E. Oliveira 1067* (UB, fragment MO). **Ceará:** Ibiapina (?), *Allemão de Cysneiros 1045* (P).

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A New Species of *Styloceras* (Buxaceae) from Peru

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ABSTRACT. A new species of Buxaceae from the central Peruvian Andes is described as *Styloceras penninervium*.

While revising collections of *Styloceras* during the process of identifying the first collection of this genus from Venezuela (Bautista & Aymard, in press), the junior author discovered two specimens that do not fit any of the described species. He brought them to the attention of the senior author, who has previously studied this genus (Gentry & Foster, 1981). We concur that they represent a new species, which is described here.

Styloceras penninervium A. Gentry & Aymard, sp. nov. TYPE: Peru. Junín: Provincia Tarma, sector "Agua Dulce," 1,800 m, 23 Mar. 1948 (fl), *Woytkowski 35497* (holotype, MO). Figure 1.

Arbor parva dioecia. Folia anguste elliptica, glabra, coriacea, pinnatim nervata. Inflorescentia masculina axilaris, spicata, 3–6 cm longa, floribus apetalis, subsessilibus, bracteolis ovatis subtentis, antheris 2–2.5 mm longis. Fructus globosus 2–2.5 cm diametro, stigmatum duorum elongatorum basibus disjunctis 1 cm.

Dioecious shrub or small tree to 4 m tall, the branchlets glabrous, striate. Leaves alternate, 12–18 cm long, 5–9 cm wide, elliptic to narrowly elliptic, coriaceous, glabrous above and below, the margin revolute, apex acutish, sometimes minutely emarginate, cuneate at base, the midvein prominent below and impressed above, pinnately veined, the secondary veins plane above and nearly plane below, the tertiary venation barely visible, plane above and below; petioles canaliculate, glabrous, 2–3 cm long, 2–3 mm wide. Masculine inflorescence an axillary spike, in fascicles of 1–3, glabrous, striate, 3–6 cm long, the apetalous flowers subsessile on pedicel ca. 1 mm long, subtended by an acuminate deltoid-ovate bract 3–4 mm long and 2–3 mm wide; the flowers apetalous, the 12–17 naked anthers 2–2.5 mm long. Fruits pedicellate, globose, 2–2.5 cm diam., the pedicels glabrous, 1–2 cm long, with several small triangular bracts 1–1.5 mm long, the minute calyx persistent, with 5 triangular lobes, the two conspicuous stigmas persistent, recurved at apex, ca. 2 cm long, the bases separated by 1 cm, irregularly dehiscing.

Distribution. Known only from the eastern slope of the central Peruvian Andes between 1,800 and 1,850 m.

Styloceras penninervium differs from all four of the previously known *Styloceras* species in its pinnately veined leaves, not at all triplinerved at the base. It also has the secondary veins less prominent below than in any of the known species. On the basis of the large fruits, one of the specimens of *S. penninervium* was originally identified (with a query) as a variant of lowland *S. brokawii* A. Gentry & R. Foster, the species that is also most similar in having the least strongly 3-veined leaves heretofore known in the genus. However, *S. brokawii* differs in the very different, more slender male inflorescence with smaller (1 mm long) bracts subtending smaller flowers with anthers ca. 1 mm long. It also is distinct in the much thinner leaf texture and more broadly elliptic leaves with a distinctly 3-plinerved base. On the basis of the relatively dense inflorescence, rather large anthers, and coriaceous leaves, *S. penninervium* is closer to *S. laurifolium* (Willdenow) HBK, which grows at higher altitudes (2,300–3,800 m), and differs strongly in the more pronounced secondary veins and especially in having the basal pair of lateral veins strongly ascending. It also differs in having a smaller fruit 1.5–2 cm in diameter.

Paratype. PERU. **Pasco:** Provincia Oxapampa, 5 km SE of Oxapampa, 1,850 m, 75°23′W, 10°36′S, 1 Feb. 1983 (fr), *D. Smith 3206* (MO, USM).

KEY TO THE FIVE SPECIES OF *STYLOCERAS*

1a. Leaves pinnately veined; secondary veins below plane or barely prominulous . . . . . .
. . . . *S. penninervium* A. Gentry & G. Aymard C.

Figure 1. *Styloceras penninervium* A. Gentry & Aymard. —A. Habit (*Woytkowski 35497*, MO). —B. Fruit (*D. Smith 3206*, MO).

1b. Leaves 3-plinerved; secondary veins prominent below.
2a. Stigma bases fused in fruit; tertiary veins distinctly raised below .... *S. columnare* Müller Argoviensis
2b. Stigma bases separated by >3 mm in fruit; tertiary veins plane below, the lower surface smooth between the secondary nerves.
3a. Inflorescence consistently monoecious, with apical female flowers; anthers 3 mm long; Ecuador .... *S. kunthianum* Jussieu
3b. Plants mostly dioecious (rarely with a female flower at base of male inflorescence); anthers 1–2 mm long; Bolivia to Venezuela.
4a. Leaves coriaceous, strongly 3-veined from near base; anthers 1.5–2 mm long; fruit 1.5–2 cm diam.; southern Peru to Venezuela, above 2,200 m .... *S. laurifolium* (Willdenow) HBK
4b. Leaves chartaceous or firmly membranaceous, weakly 3-veined from near base; anthers 1 mm long; fruit 2–3 cm diam.; lowland Bolivia and southern Peru .... *S. brokawii* A. Gentry & R. Foster

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Anomatheca laxa subsp. *azurea* (Iridaceae), a New Subspecies from Coastal Southern Mozambique and Natal, South Africa

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ABSTRACT. Populations until now treated as *Anomatheca laxa* that occur along the coast of northern Natal and southern Mozambique are referred to a new subspecies *azurea*. These plants differ in their pale blue perianth with dark blue to violet markings and in their generally smaller flowers with a fairly long perianth tube. Subspecies *azurea* flowers in the cool months, June to mid-September, and is restricted to sandy soils, unlike typical red- to pink-flowered subspecies *laxa*, which flowers mainly from November to February, and is largely montane, favoring rocky sites.

White- to pale blue-flowered plants with dark blue to violet or purple marks on the lower tepals currently included in *Anomatheca laxa* (Thunberg) Goldblatt, one of five species currently admitted to this tropical and southern African genus (Goldblatt, 1972, 1991), have long seemed awkwardly placed. Except for flower color, however, there seemed little to separate the white- to pale blue-flowered individuals from typical *A. laxa*, which has pink to red flowers with dark red blotches at the bases of the three lower (anterior) tepals. Examination of additional specimens of the blue-flowered plants in preparation for a treatment of Iridaceae for *Flora Zambesiaca* (Goldblatt, in press) indicates a need for their taxonomic recognition, and they are described here as subspecies *azurea*.

Typical *Anomatheca laxa* [Syn. *Lapeirousia cruenta* Lindley; *Anomatheca cruenta* (Lindley) Baker], extends from the Uitenhage District in the southeastern Cape (South Africa), probably the type locality, through eastern tropical Africa to Uganda and western Kenya (Fig. 1). The range is, however, discontinuous, and *A. laxa* evidently does not occur in Zimbabwe, central and northern Mozambique, or southern Malawi, although it is present in central and northern Zambia, Shaba Province (Zaire), and southern Tanzania. Further north it is restricted to the mountains of eastern and northern Uganda and western Kenya. Plants generally favor rocky sites in light shade in mountain areas, but in South Africa they occasionally occur close to sea level. Related, and the only other tropical member of the genus, *A. grandiflora* Baker, which extends from the Transvaal (South Africa) to southern Tanzania, occurs in light woodland and open savanna, habitats generally drier than those favored by *A. laxa*.

In contrast to the wide geographic range of subspecies *laxa*, subspecies *azurea* is restricted to coastal habitats in southeastern Africa from Richards Bay, Natal, in the south to Massinga, Mozambique, in the north (Fig. 1). As far as we know, subspecies *azurea* always grows in coarse sand, either in exposed sites such as grassy dunes or sometimes in light shade. Also, unlike subspecies *laxa* these coastal plants only flower in the winter and early spring, June to September. Occasionally its flowering overlaps with that of subspecies *laxa*, which has been

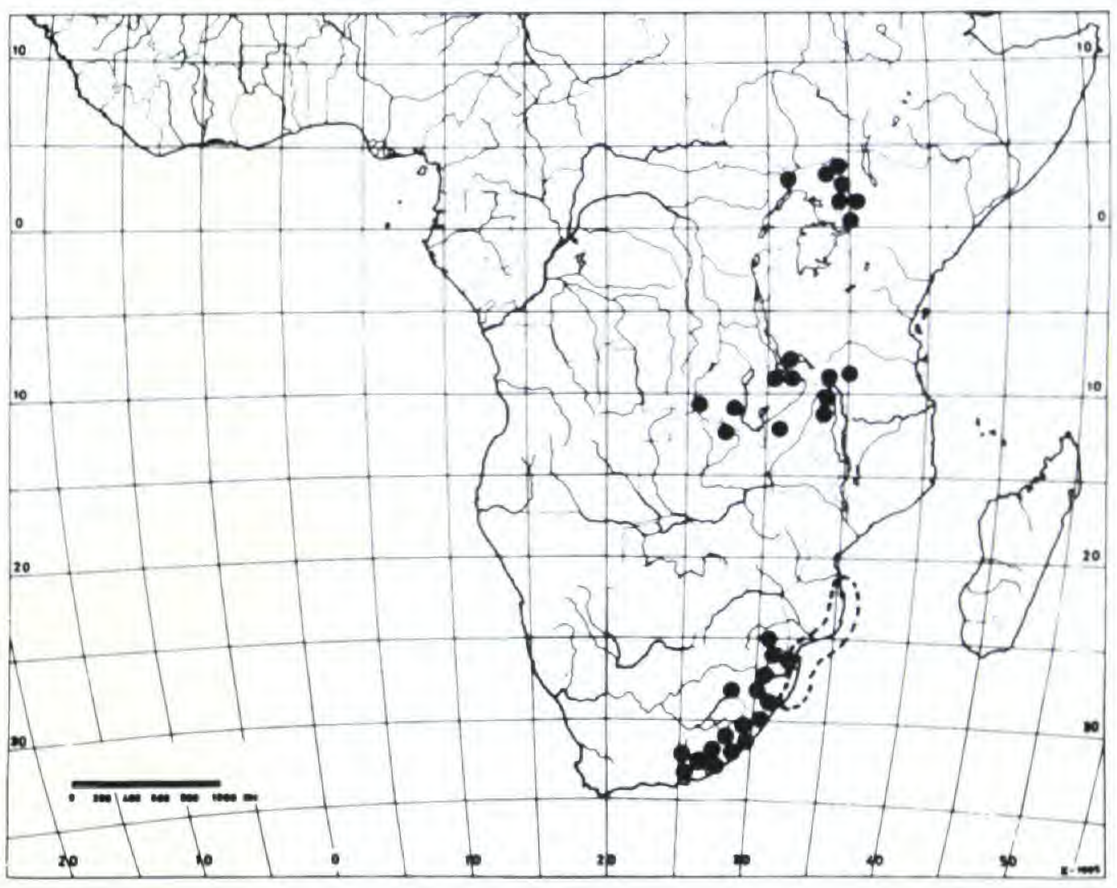

Figure 1. Distribution of *Anomatheca laxa*. Closed circles = subspecies *laxa*; broken line = subspecies *azurea*.

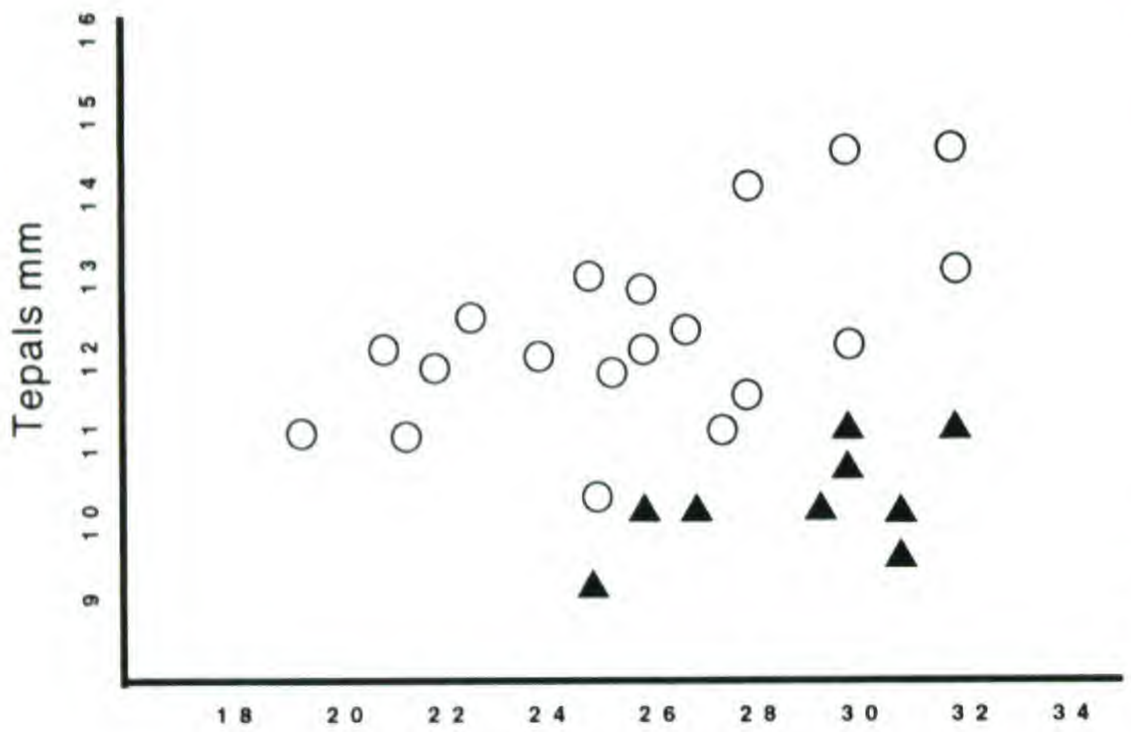

Figure 2. Graph showing the relationship between perianth tube length and tepal length. Circles = plants with pink to red flowers with dark red markings (subspecies *laxa*); triangles = plants with white to pale blue flowers with blue to violet markings (subspecies *azurea*).

recorded in flower from August to February, although mostly November to January. In coastal Zululand, both typical subspecies *laxa* and the blue-flowered subspecies *azurea* are known to occur in close proximity. Near Kwambonambi at a disturbed site in the Amangwe forest in Zululand, a series of hybrids occurs among the typical pale bluish subspecies *azurea* and some plants that resemble closely subspecies *laxa* (*Hutchings & Hutchings 3019, 3020*).

Color differences alone are seldom sufficient evidence for taxonomic recognition, but in *Anomatheca laxa* this is correlated with separate flowering times and habitat preferences. There also seems to be a nearly absolute difference in perianth size (Fig. 2). Healthy plants of subspecies *laxa* have a perianth tube (19–)21–28(–32) mm long and tepals 11–13 (–15) mm long. In contrast, flowers of subspecies *azurea* have a tube (25–)27–32 mm long and tepals 9–11 mm long (measurements from herbarium specimens). Flower size alone may be sufficient to separate the subspecies, but in conjunction with perianth color, habitat, and flowering time there is little chance of confusing them. Care must be taken in making measurements to have well pressed, fully expanded flowers of healthy plants—depauperate individuals or those at the end of their flowering often have smaller flowers; also depending on care with specimen preparation, flowers may shrink to 80% of original size.

We believe that subspecies rank for the white- to pale blue-flowered populations of *Anomatheca laxa* is appropriate in view of its generally close resemblance to typical *A. laxa*, and the considerably greater difference between all the populations of *A. laxa* and the other species of the genus.

Systematics

Anomatheca laxa subspecies **azurea** Goldblatt & Hutchings, subsp. nov. TYPE: Mozambique. Maputo: Inhaca Island, 20 July 1980, *de Koning & Navunga 8312* (holotype, LMU; isotypes, BR, K, MO, SRGH).

Plantae floribus pallide albescentibus ad caeruleos, basi tepalorum inferiorum atrocaerulea ad violaceam notata, tubo perianthii (25–)27–32 mm longo, tepalis 9–11 mm longis, antheris ca. 4 mm longis.

Plants with pale bluish (to nearly white) flowers, the lower three tepals each with a dark violet to indigo blotch near the base. *Perianth tube* (25–)27–32 mm long; *tepals* 9–11 mm long, elliptic, ca. 4 mm wide. *Filaments* exserted for ca. 1 mm; *anthers* ca. 4 mm long. *Style* dividing just above the base of the anthers, the branches ca. 2.5 mm long, forked for ca. 1 mm, and tangled in the anthers.

Occurring along the coast in sandy soil, usually in sun, or in light shade; flowering mainly June to August.

Differing from subspecies *laxa* in the white to pale blue flowers with dark blue to violet or purple markings at the base of the three lower tepals, subspecies *azurea* also generally has a longer perianth tube, usually (25–)27–32 mm long and smaller tepals, 9–11 mm long. Pink- to red-flowered subspecies *laxa* has dark red marks at the bases of the lower tepals, a tube (19–)21–28(–32) mm long and tepals 11–13(–15) mm long. Flowers are seldom well enough preserved for us to be sure how constant other floral differences are, but there is at least a tendency for the filaments of subspecies *laxa* to be somewhat longer and exserted 1.5–2 mm from the tube. The style of subspecies *laxa* also seems to be somewhat longer than in subspecies *azurea*, dividing opposite the middle of the anthers. Examination of additional living populations may make it possible to determine whether these differences are consistent.

Paratypes. MOZAMBIQUE. **Inhambane:** Massinga, rio das Pedras, 8 July 1981, *de Koning & Hiemstra 8933* (BR, LMU, MO, SRGH); Massinga, Pomene, 13 July 1981, *de Koning & Hiemstra 9007* (LMU, MO). **Gaza:** between Chiconela and Gumbe, 26 May 1965, *Pereira, Marques & Balsinhas 469* (LMU); Bilene, sand in dense bush, 31 July 1948, *Torre 8046* (LISC); Vila de Joao Belo, Limpopo mouth, 17 June 1960, *Lemos & Balsinhas 136* (K, LISC). **Maputo:** Inhaca Island, 10 July 1957, *Barbosa 7626* (K, LMA); Maputo, Ponta do Ouro, 9 July 1961, *Myre & Macedo 4344* (LMU); Maputo, Ponta Malongane, 18 July 1971, *Correia & Marques 2194* (LMU, WAG). SOUTH AFRICA. **Natal:** Kosi Bay, sea level, 13 July 1947, *Bayer T26* (NU); Sodwana State Forest, burned grassland, 30 m, 7 July, *Nicholas*

1467 (NH); St. Lucia, outside crocodile farm, 21 Aug. 1991, *Hutchings & Hutchings 3017* (MO); grassland around Mt. Tabor, St. Lucia, Eastern Shores State Forest, 25 June 1989, *Phillipson 3196* (MO, RUH); St. Lucia Estuary, dune forest, Aug. 1984, *Balkwill & Cadman 1728* (NU); Mapalane, 16 Aug. 1991, *Hutchings & Hutchings 3016* (MO); Kwambonambi, Amangwe Forest, 25 Aug. 1991, *Hutchings & Hutchings 3019* (MO); Monzi turnoff on road to Mtubatuba, forest track, 9 Aug. 1977, *Pooley 1870* (NU); Richards Bay, 26 July 1974, *Ward 5* (NU), 4 Sep. 1970, *Strey 9906* (NH).

Key to the Subspecies

1a. Flowers pink to red usually with dark red markings on the lower tepals; perianth tube 19–28 (–32) mm long; dorsal tepal 11–15 × 5 mm ..... subsp. *laxa*

1b. Flowers pale blue to whitish with dark blue to violet markings on the lower tepals; perianth tube (25–)27–32 mm long; dorsal tepal 9–11 × 4 mm ..... subsp. *azurea*

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Ixia acaulis, a New Acaulescent Species of Iridaceae: Ixioideae from the Knersvlakte, Namaqualand, South Africa

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ABSTRACT. The generic placement of a new species, *Ixia acaulis*, from limestone outcrops in the Knersvlakte, Vanrhynsdorp District, South Africa, is not immediately clear in part due to its reduced acaulescent habit. The bright yellow flowers have a subterranean ovary and are borne above ground level on a long perianth tube. An acaulescent habit is unusual in Iridaceae, although known in several genera of the two larger subfamiles, Iridoideae and Ixioideae. In an effort to correctly assign the plant to a genus, we have examined leaf anatomy and chromosome cytology as well as macromorphology and palynology. A basal rooting corm places the species firmly in Ixioideae, as does the perforate exine sculpturing. We conclude that it belongs in the southern African genus *Ixia*, although an acaulescent habit is otherwise unknown in this genus and other aspects of the plant do not exactly conform to this genus.

The uncertain generic position of a new species of Iridaceae subfamily Ixioideae from the Knersvlakte north of Vanrhynsdorp, Cape Province, South Africa, required detailed investigation of its morphology, leaf anatomy, cytology, and palynology. It is unusual in the subfamily in lacking an aerial stem. The flower has a subterranean ovary and is raised above the ground by means of a long perianth tube. Finely fibrous corm tunics seem to preclude any relationship with *Hesperantha*, *Romulea*, or *Syringodea*, in which acaulescence is the rule or at least not uncommon, but in which the corm tunics are more or less woody. However, a combination of reduced and specialized features makes it uncertain whether the species belongs in *Ixia*, *Tritonia*, *Sparaxis*, *Anomatheca*, or *Duthieastrum*, all of which have fibrous corm tunics, but only the last is normally acaulescent.

MORPHOLOGY

VEGETATIVE ORGANIZATION

The small plants (Fig. 1A, B) grow singly or in small clumps, each individual consisting of an elongate, more or less symmetrical, round-based corm with fibrous corm tunics (Fig. 1B) that accumulate in older plants to form a thick matted fibrous layer. The corms produce roots from the basal area but in no particular pattern. The 3–5 foliage leaves are basal and sheathed below the ground by 2 membranous, entirely sheathing cataphylls. The leaf blades are equitant and more or less linear. Under natural conditions the blades are more or less prostrate on the ground. Although the blades are unifacial, there is no morphological or anatomical differentiation between the leaf surfaces facing toward or away from the surface of the ground. Grown under greenhouse conditions with more water than normally available (as were the plants illustrated), the leaves tend to be inclined rather than prostrate. The stem is short, 1–2 cm long, but does not reach ground level at anthesis and bears one or occasionally two flowers. As the capsules ripen the peduncle elongates so that the seeds are released at ground level.

FLORAL STRUCTURE

The flowers are sessile (i.e., lack pedicels) and are subtended by a pair of opposed membranous bracts inserted at the base of the ovary (Fig. 1C, G), thus conforming to the pattern in all Ixioideae. In the three other subfamilies of Iridaceae the flowers are normally pedicellate, rarely sessile, and always subtended by a single bract (Goldblatt, 1990). Also typical of Ixioideae, the outer bract is larger than the inner in *Ixia acaulis*, although the two bracts are more or less equal in length (Fig. 1G). The inner bract is 2-veined and apically forked. The

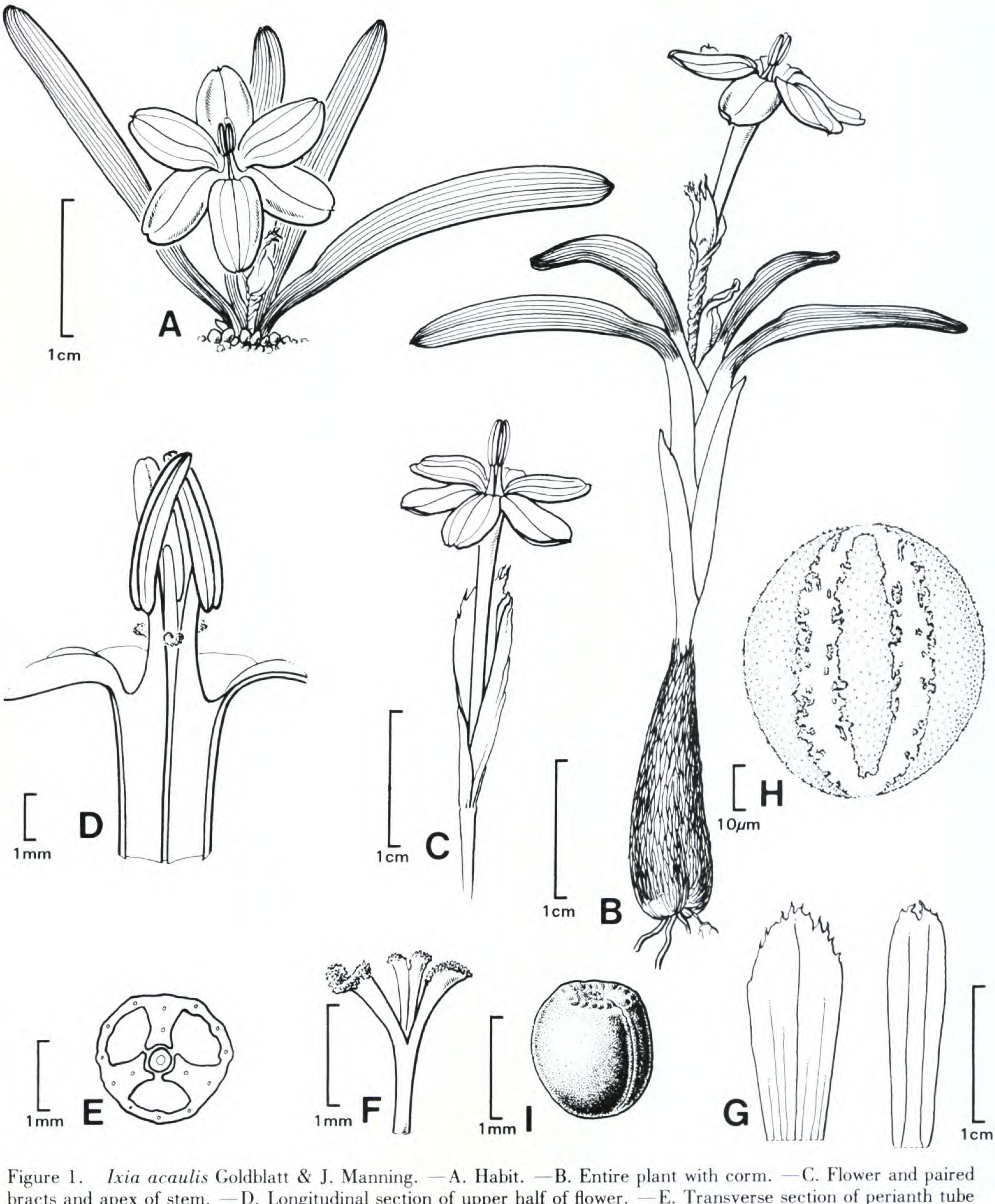

Figure 1. *Ixia acaulis* Goldblatt & J. Manning. —A. Habit. —B. Entire plant with corm. —C. Flower and paired bracts and apex of stem. —D. Longitudinal section of upper half of flower. —E. Transverse section of perianth tube at mid level showing filament flanges and central style. —F. Detail of style branches. —G. Detail of outer and inner bracts. —H. Polar view of pollen grain with operculum lying over the aperture. —I. Seed. (Drawn by J. C. Manning.)

ovary is subterranean and the flower is raised above the ground by a long perianth tube, 15–20 mm long, that reaches about 10 mm above ground. The flower is actinomorphic and the bright yellow tepals are subequal and spread at right angles to the tube (Fig. 1B, C). The short filaments are exserted ca. 1.5 mm from the perianth (Fig. 1D) and are decurrent, extending to the middle of the tube as flanges that reach almost to the center of the tube (Fig. 1D, E). The filiform style reaches to about the mouth of the tube where it divides into three short branches, ca. 1 mm long, and each branch is adaxially channeled above, but the margins are conduplicate below so that the lower two-thirds are tubular

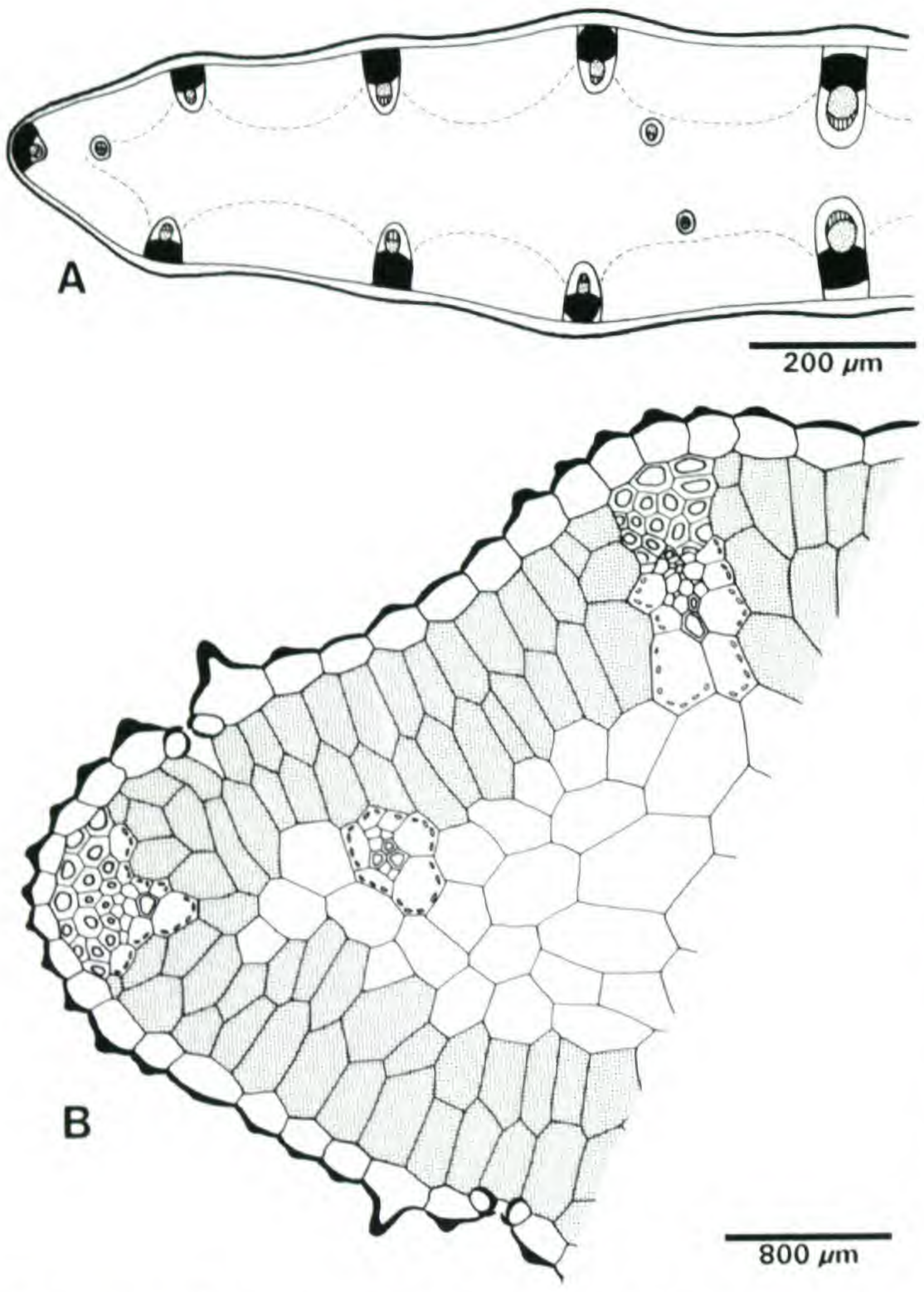

Figure 2. Transverse section of leaf of *Ixia acaulis*. — A. Tissue distribution in half leaf (pseudomidrib vein pair to margin). —B. Cell detail of marginal area (palisade mesophyll shaded). (Drawn by J. C. Manning.)

(Fig. 1F). The stigmatic tips of the style branches emerge between the adjacent filaments a short distance below the base of the anthers (Fig. 1D). The erect and more or less parallel anthers are linear-oblong, submedianly fixed, and longitudinally dehiscent (Fig. 1D).

FRUIT AND SEED

The fruit is a globose capsule with somewhat cartilaginous walls, corresponding to the presumed plesiomorphic state for Ixioideae. The seeds are globose, extremely hard, and lack primary or secondary sculpturing (Fig. 1I). The only notable feature is the white filiform vestige of the ovular vasculature lying over the raphe, thus outside the body of the mature seed. This seed type is derived in shape, absence of surface sculpturing, and in the peculiar excluded vascular trace (Manning & Goldblatt, in prep.). Similar hard rounded seeds without primary or secondary sculpturing characterize several genera of Ixioideae tribe Ixieae, among them *Sparaxis*, *Ixia*, *Dierama*, *Duthieastrum*, *Tritonia*, its close allies *Crocosmia*, *Chasmanthe*, and *Devia* (de Vos, 1974; Goldblatt & Manning, 1990; in prep.), as well as *Freesia* and most species of *Anomatheca*. The two latter have a characteristically inflated raphe (Goldblatt & Manning, in prep.) and do not have the excluded vascular trace that occurs in the other genera listed above (seeds of *Duthieastrum* are unknown in this respect).

LEAF ANATOMY

In cross section (Fig. 2) the blades of the unifacial leaves are oblong and conform to the basic pattern for Iridaceae (Arber, 1921; Rudall & Goldblatt, 1989) in having vascular bundles in two opposed rows, with the phloem directed toward the epidermis and the xylem toward the interior of the leaf. The median pair of veins are slightly larger than the others and thus constitute a pseudomidrib, generally visible as such in surface view. The epidermal cells are slightly wider than high and papillate; the marginal epidermal cells are similar to those of the laminar surface except in their slightly smaller size (Fig. 2B). Stomata are sunken and the guard cells are small. Immediately below the marginal epidermis there is a small strand of sclerenchyma (= phloem cap) contiguous with the phloem of a small marginal vein. There is a well-developed palisade two cell layers thick and a sclerenchyma phloem cap on all primary and secondary bundles reaching the epidermis in all bundles except the median pair. The bundle sheaths are unthickened except at the phloem pole. Presence of submarginal sclerenchyma associated with a marginal vein is probably plesiomorphic for Ixioideae (Rudall & Goldblatt, 1989; Goldblatt, 1990), and a pseudomidrib is plesiomorphic for tribe Ixieae. The leaf anatomy thus corresponds with the basal condition for Ixieae (Rudall & Goldblatt, 1989), including *Ixia* and *Dierama* among genera possibly closely related to the new species.

A derived leaf margin anatomy in which the leaf margin cells are columnar and heavily thickened on the anticlinal walls and the margins lack subepidermal sclerenchyma characterizes *Tritonia* (excepting *T. marlothii* and *T. delpierrei*) (de Vos, 1980), *Sparaxis* (including *Synnotia*), *Anomatheca*, and a few more genera (Rudall & Goldblatt, 1989). *Duthieastrum* has leaves without either subepidermal marginal sclerenchyma or columnar marginal epidermal cells with thickened walls, but it does have a marginal vein (Goldblatt, unpublished).

POLLEN GRAINS

The pollen grains (Fig. 1H), examined in the fully expanded state in 1% aceto-orcein, are monosulcate and rounded, ca. 62 × 54 μm, thus slightly longer in the plane of the sulcus. The sulcus has a conspicuous, narrowly elliptic operculum lying across

the long axis and nearly as long as the sulcus and ca. 12 μm wide in the midline. The exine is perforate with the surface bearing scattered small spinulae. Both in the presence of an operculum and in the perforate and sparsely spinulate exine the species corresponds with the plesiomorphic state for Ixioideae (Goldblatt, 1990). In the presumed plesiomorphic condition for the subfamily, also the most common, the operculum is double-banded (Goldblatt et al., 1991). A derived single-banded operculum is so far known only in *Ixia*, some species of *Anomatheca* (Ixieae), and *Lapeirousia* and *Thereianthus* (Watsonieae) (Goldblatt et al., 1991; Goldblatt & Manning, in prep.). Apparently only in *Ixia* is the operculum consistently single-banded, although only a selection of species have so far been examined. The grains are some 30% larger than recorded in other species of *Ixia* (Goldblatt et al., 1991), possibly related to the long perianth tube and consequent need for larger reserves to permit growth through a longer style.

Chromosome Cytology

Root tips (examined by M. Takei), harvested from sprouting corms and treated as described by Goldblatt et al. (1993), showed a diploid chromosome number of $2n = 20$ at mitotic metaphase. The chromosomes are relatively small, the longest four pairs 2.7–2.3 μm and the smaller pairs 1.8–1.2 μm long, and asymmetric in arm ratio. The second longest and one of the shorter pairs are nearly metacentric, and the rest are acrocentric to submetacentric. The karyotype is weakly bimodal with three longer pairs standing out from the remaining shorter chromosomes. Satellites were not seen clearly but appear to be small and located on one of the longer chromosome pairs. Other Ixioideae with a base number of $x = 10$ (Goldblatt, 1971; de Vos, 1974) include *Ixia*, *Dierama*, *Sparaxis* (including *Synnotia*), and *Duthieastrum* (all Ixieae) and *Thereianthus*, *Micranthus*, and section *Fastigiata* of *Lapeirousia* (Watsonieae) and *Pillansia*, only genus of Pillansieae. The ancestral base number for Ixioideae may be $x = 10$. In general size the chromosomes of *Ixia* correspond most closely with those of the new species. Chromosomes of *Sparaxis* are some 20% smaller (total chromosome length) (Goldblatt & Takei, in prep.) and exhibit no bimodality.

Discussion

Generic Position

A basally rooting corm, long-lasting flowers with a well-developed perianth tube, paired bracts inserted below a sessile ovary, operculate pollen grains, and perforate exine, synapomorphies for Ixioideae (Goldblatt, 1991; Goldblatt et al., 1991), are all present in *Ixia acaulis* and confirm its subfamilial position. Within Ixioideae it corresponds with Ixieae and Watsonieae in having leaves with a pseudomidrib. Association with Watsonieae may be excluded because members of this tribe have corms that develop entirely from an axillary bud (the new corm lies lateral to the flowering stem), and they also have deeply divided style branches, the former possibly apomorphic and the latter almost certainly so (Goldblatt, 1990, 1991). There is little doubt that the new species belongs in Ixieae. Among the 20 genera of the tribe, the new species has similarities with several genera, especially *Tritonia*, *Duthieastrum*, *Anomatheca*, and *Ixia*, although the acaulescent condition and subterranean ovary are atypical of all but the monotypic *Duthieastrum*. Only one species of *Tritonia*, *T. florentiae* (E. Phillips) Goldblatt, lacks an aerial stem, but no acaulescent species of *Ixia* or *Anomatheca* are known. Acaulescence has apparently evolved repeatedly in Iridaceae and frequently in Ixioideae, in which at least some species of *Lapeirousia* and *Hesperantha*, most species of *Romulea*, and all of *Syringodea* and *Crocus* (as well as *Duthieastrum*) lack an aerial stem at anthesis. Acaulescence, especially common in African Ixioideae among species of arid and semiarid areas, is obviously of direct adaptive significance, and alone is probably of little or no value in considering the relationships of species of Ixieae.

More important in determining relationships among Ixioideae are the nature of the style branches (either simple or deeply divided), leaf margin anatomy, bract texture (green and herbaceous or membranous and transparent or scarious), seed morphology, and possibly pollen grain morphology. The most likely generic position for this new species seems to us to be *Ixia*, with which it corresponds mainly in plesiomorphic features (unspecialized leaf anatomy, chromosome number, simple style branches); it also shares a notable synapomorphy with *Ixia*, pollen grains with a single-banded operculum. The membranous and transparent bracts may also be apomorphic for *Ixia*.

In some species of *Ixia* alone of the genera of Ixioideae, the style divides at the mouth of the perianth tube and has short branches (in *Hesperantha* the style consistently divides at or below the mouth of the tube but the branches are long and trailing). The new species does not accord with *Anomatheca*, *Tritonia*, *Duthieastrum*, or *Sparaxis* in leaf margin anatomy or pollen grain structure. These four genera have columnar marginal epidermal cells

and, except for *Duthieastrum*, lack submarginal sclerenchyma whereas their pollen grains have double-banded opercula. Additionally, the style branches of *Anomatheca* are always deeply divided, and the seeds of this genus do not have an excluded vascular trace. Basic chromosome number in *Sparaxis* is also $x = 10$, but both *Tritonia* and *Anomatheca* have $x = 11$, excepting one derived species of *Tritonia*, *T. florentiae*, which has the secondary base of $x = 10$ (Goldblatt & Takei, in prep.).

RELATIONSHIPS WITHIN *IXIA*

Ixia subg. *Dichone* is derived in the genus in its peculiar, stout, and so-called subdidymous anthers (Lewis, 1962), which appear to lack a connective and are additionally normally (possibly always) basally porate. The six species of the subgenus also always have pink flowers and, according to Lewis (1962), involute style branches. Thus, *I. acaulis* falls within the remaining subgenus *Ixia*, where it accords best with section *Hyalis* and *Morphixia*. It may be most closely related to *I. paucifolia* of the latter (de Vos, pers. comm.), which also has a long perianth tube, and included, decurrent filaments. In one aspect, however, *I. acaulis* seems to differ from *Ixia:* it has subcentrally fixed anthers, whereas near basifixed anthers are characteristic of the genus, according to de Vos (pers. comm.).

SYSTEMATICS

Ixia acaulis Goldblatt & J. Manning, sp. nov. TYPE: South Africa. Cape: 31.18 (Vanrhynsdorp) Knersvlakte, farm Rooiberg, low limestone ridges (BC), 19 May 1992, *Snijman & Manning 1249* (holotype, NBG; isotypes, MO, PRE). Figure 1.

Plantae 2–3 cm altae, interdum caespitosae, cormo elongato, tunicis fibrosis, foliis productis 3–5, laminis lineato-lanceolatis 2–4 mm latis, floribus solitaris actinomorphis flavis, tubo perianthii 15–20 mm longo, tepalis aequalibus ovato-oblongis 6–7 × 3 mm, filamentis erectis ca. 1.5 mm longis, antheris linearo-oblongis erectis contiguis ca. 2 mm longis, stylo diviso prope apicem tubi, ramis styli ca. 1 mm longis.

Plants acaulescent, often growing in small clumps, leaves and flowers reaching 2–3 cm above the ground. *Corm* elongate, ca. 3–4 mm wide near the base, tapering above, ca. 15 mm long, the tunics moderately to finely fibrous and with age accumulating as a dense covering. *Foliage leaves* 3–5, all basal, sheathed below by 1–2 transparent cataphylls, these just reaching ground level; leaf blades linear to narrowly lanceolate, ca. 1.5–2 mm wide, often prostrate, or inclined toward the ground, ± obtusely acuminate. *Stem* subterranean, 9–18 mm long, usually unbranched or with one branch. *Inflorescence* a solitary flower (or the flowers solitary on each branch); *bracts* membranous, the outer larger, ca. 10 mm long, somewhat fringed along the upper margin, inner bract about as long but narrower, 2-veined and lightly forked apically, reaching to 5 mm above the ground. *Flowers* actinomorphic, bright yellow, whitish in the tube; *perianth tube* 15–20 mm long, arising below ground level and extending to 10 mm above the ground, cylindric, widening gradually above; *tepals* subequal, oblong-ovate, obtuse to emarginate, 6–7 × 3 mm, spreading at right angles to the tube. *Stamens* erect, the filaments arising at the top of the tube, ca. 1.5 mm long, decurrent and forming prominent ridges reaching downward to the middle of the tube, the ridges extending inward to the style but not joined to it; *anthers* linear-oblong, longitudinally dehiscent, subcentrally fixed, erect and ± contiguous, ca. 2 mm long. *Ovary* oblong, ca. 2.5 mm long; *style* filiform, dividing at or just beyond the mouth of the tube, the branches short, ca. 1 mm long, the apices emerging between the filaments, terminally stigmatic, adaxially channeled in the upper part but the margins conduplicate below and the branches thus tubular in the lower half. *Capsules* globose, 5–6.5 mm long, borne at ground level. *Seeds* few per locule (usually 3–4), globose, smooth, dark red-brown, ca. 1.5 mm diam., the vascular trace excluded and often persisting as a white strand along the raphe. *Chromosome number* $2n = 20$.

DISTRIBUTION AND HABITAT

Ixia acaulis appears to be restricted to limestone ridges, clearly a specialized habitat, in the arid Knersvlakte of southern Namaqualand. This area of low rainfall, less than 100 mm p.a., normally falling in the winter months, is known for its diversity of habitats and extreme local endemism, particularly among Aizoaceae–Mesembryanthemoideae. Iridaceae are not well represented here, but other Knersvlakte endemics in the family include *Homeria maximiliani* Schlechter, *Moraea deserticola* Goldblatt (both Iridoideae), and *Lapeirousia angustifolia* Schlechter (if this is regarded as distinct from the related *L. pyramidalis* (Lamarck) Goldblatt). Among these Iridaceae, *I. acaulis* is unusual in flowering at the beginning of the wet season in May (and possibly June) rather than in the early spring in July and August. This unusual flowering time as well as the specialized habitat together account for its late discovery in an area that has been explored botanically since the late 19th century. So far, *I.*

acaulis is known from two limestone ridges on the farm Rooiberg just to the north of the Saldanha–Sishen rail line. It grows in rock cracks or wedged between boulders in a virtually lithophytic situation. The few other limestone outcrops in the Knersvlakte, an area of predominantly fine clay soils often covered by a dense superficial layer of quartz pebbles, remain to be examined for the presence of the species.

Paratypes. SOUTH AFRICA. **Cape Province:** 3118 (Vanrhynsdorp) Knersvlakte, Farm Rooiberg, low limestone ridges (BC), *Perry*, 1991 (NBG), 27 Aug. 1991 (fr), *Goldblatt & Manning 9132* (MO, NBG, PRE).

Acknowledgments. This work was supported in part by the U. S. National Science Foundation grant BSR 89-06300. We recognize the discovery of this new species by Pauline Perry and thank her for providing the live specimens studied here. We also express our thanks to M. P. de Vos, Stellenbosch, South Africa, for constructive comments on the manuscript.

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A New Combination for the Single American Element of *Parasenecio* (Asteraceae: Senecioneae)

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ABSTRACT. In accordance with the acceptance of the generic name *Parasenecio* for the Asiatic-centered species historically referred to *Cacalia*, a new combination is made for the single species that ranges to North America: *Parasenecio auriculata* (A. P. de Candolle) J. R. Grant.

Cacalia auriculata was described by A. P. de Candolle (1837) from a specimen collected in 1835 by Turczaninow between Yakutsk and Okhotsk, Yakutia, Russia. It ranges from Kamtchatka to the Commander and Kurile Islands (Russia), to Hokkaido and northern Honshu (Japan), and from the Russian Far East to Manchuria (China) and Korea (Hultén, 1930). In Alaska, it has been collected on five islands at the westernmost end of the Aleutian chain roughly adjacent to the Commander Islands, Attu, Agattu, and Alaid of the Near Islands, and Kiska and Buldir of the Rat Islands.

Cacalia auriculata is one of a number of species of primarily Asiatic distribution that ranges to the westernmost islands of the Aleutian chain. Hultén (1937) documented the American range for several species with this type of distribution pattern including *Senecio palmatus* Pallas and *Cirsium kamtchaticum* Ledebour. The vegetation of the islands where these species are found is "a distinctly Kamtchatkan type" (Hultén, 1937: 37). The presence of these species in the Aleutians is due to their association with "high-grown vegetation" typical of Kamchatka that also extends to the Near and Rat Island groups, but is unknown to the remainder and majority of the Aleutian chain (Hultén, 1937).

Robinson & Brettell (1973) described the genus *Koyamacalia* for the Asian species referred to *Cacalia*. *Cacalia auriculata* was transferred into *Koyamacalia* along with 46 other species (Robinson & Brettell, 1973). Jeffrey & Yi-Ling (1984) pointed out that *Koyamacalia* H. E. Robinson & R. D. Brettell was a later synonym of *Parasenecio* W. W. Smith & Small. Jeffrey (1992) again commented on *Parasenecio*, but as in the earlier work, no new combinations were made. In order to update nomenclature in the North American flora, the following new combination is made:

Parasenecio auriculata (A. P. de Candolle) J. R. Grant, comb. nov. Basionym: *Cacalia auriculata* A. P. de Candolle, Prod. 6: 329. 1837 [1838]. TYPE: Inter Ochotiam [Okhotsk] et Jacutiam [Yakutsk], *N. Turczaninow s.n.* (holotype, G-DC, photo on microfiche seen).

Ligularia auriculata Turczaninow ex A. P. de Candolle, Prod. 6: 329. 1837, pro syn.
Koyamacalia auriculata (A. P. de Candolle) H. E. Robinson & R. D. Brettell, Phytologia 27: 271. 1973.

Specimens examined. UNITED STATES. **Alaska:** Near Islands, Attu Island, 13°52′56″N, 173°15′E, 25 July 1943, *Beals A* (ALA); Attu Island, 13°52′56″N, 173°15′E, *Beals*, 1943 (ALA); Attu Island, Massacre Bay area, 10 July 1973, *Williams 3212* (US); Agattu Island, 13°52′26″N, 17°33′06″E, 13 Aug. 1974, *Trapp 104* (ALA); Attu Island, Peaceful Valley, near Navy Town, 13°52′50″N, 173°11′E, 18 Aug. 1983, *Friedman & Michaelson 83-64* (ALA); Rat Islands, Buldir Island, 14°52′21″N, 175°56′E, 14 July 1974, *Dick 164* (ALA); Buldir Island, 14°52′21″N, 175°56′E, 25 Aug. 1974, *Dick 403* (ALA).

Acknowledgments. I thank Harold E. Robinson (Smithsonian Institution) for bringing my attention to this species, and for review of the manuscript. I also thank Alan R. Batten of the Northern Plant Documentation Center, Herbarium, University of Alaska Museum, Fairbanks, for sending data on the specimens at ALA.

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Change in Status of a Dwarf Mistletoe (*Arceuthobium*, Viscaceae) from China

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ABSTRACT. The taxon *Arceuthobium pini* var. *sichuanense*, a parasite of *Picea* in southwestern China, is raised to specific rank. It is allopatric with *A. pini*, which differs in its parasitism of *Pinus*, its much larger shoots, and its smaller male flowers.

A new variety, *Arceuthobium pini* Hawksworth & Wiens var. *sichuanense* H. S. Kiu, a parasite of *Picea*, was recently described from southwestern China (Kiu, 1984a). Here we raise that taxon to specific rank because of the marked differences in morphology and host relations between it and *A. pini*.

Arceuthobium sichuanense (H. S. Kiu) Hawksworth & Wiens, comb. nov. Basionym: *Arceuthobium pini* var. *sichuanense* Kiu H.-s., Acta Phytotaxonomica Sinica 22: 205, 1984. TYPE: China. Sichaun: Dawu, parasite of *Picea likiangensis* var. *balfouriana*, 4,200 m, *Wu & Gao 11629* (holotype, CDBI).

Arceuthobium sichuanense differs from *A. pini* in being a much smaller plant (shoots 2–6 cm high vs. 5–20 cm) with smaller staminate flowers (1.5–2 mm vs. 2–2.5 mm diam.). A major difference is that *A. sichuanense* parasitizes only *Picea*, whereas *A. pini* parasitizes only *Pinus*. Both species occur in Sichuan and Xizang (Tibet) in southwestern China, but they are apparently allopatric (Kiu & Wei, 1982) and occur at different elevations: *A. sichuanense* at 3,800–4,200 m and *A. pini* at 2,700–3,500 m (Kiu, 1984b). At 4,200 m, *A. sichuanense* has the highest elevational distribution of any member of the genus, although two taxa (*A. globosum* subsp. *grandicaule* and *A. vaginatum* subsp. *vaginatum*) approach this limit in central Mexico (Hawksworth & Wiens, 1972). *Arceuthobium sichuanense* is most similar to *A. tibetense* Kiu & Wei Ren, an allopatric species parasite of *Abies* in Xizang, which has even smaller shoots (0.5–2.2 cm high) (Kiu, 1984b). A key to the five taxa of *Arceuthobium* in southwestern China is given by Kiu (1984b).

Arceuthobium sichuanense has recently been found in western Bhutan, where it causes "serious damage" to *Picea likiangensis* var. *balfouriana* and *P. spinulosa* (Naithani & Singh, 1989).

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NOVON 3: 156. 1993.

Notes on the Lamiaceae of China

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ABSTRACT. Nomenclatural changes, affecting *Marmoritis* and *Scutellaria*, are made for the upcoming *Flora of China*.

Hedge (1990) resuscitated the generic name *Marmoritis* "after almost 150 years in synonymy." It replaces the previously accepted *Phyllophyton*. In this same treatment Hedge made the new combination *Marmoritis nivalis* (Jacquemont ex Bentham) Hedge and recognized *Marmoritis rotundifolia* Bentham for the flora area he was considering. In order to reflect the current taxonomic status for species formerly placed in *Phyllophyton*, the following nomenclatural changes are made. The taxonomic treatment of the following taxa, along with *Marmoritis nivalis* and *M. rotundifolia*, will appear in the *Flora of China* (Li & Hedge, in press).

Marmoritis complanatum (Dunn) H. W. Li, comb. nov. Basionym: *Nepeta complanata* Dunn, Notes Roy. Bot. Gard. Edinburgh 8: 122. 1913. *Glechoma complanata* (Dunn) Turrill, Bot. Soc. Exch. Club Brit. Isles 1919, 5: 695. 1920. *Phyllophyton complanatum* (Dunn) Kudô, Mem. Fac. Sci. Taihoku Imp. Univ. 2: 225. 1929. *Pseudolophanthus complanatus* (Dunn) Levin, Trudy Bot. Inst. Akad. Nauk S.S.S.R., Ser. 1, Fl. Sist. Vyssh. Rast. 5: 296. 1941. TYPE: China. NW Yunnan: scree plant, 16,000 ft., July 1911, *F. Kingdon Ward 138* (holotype, E not seen).

Dracocephalum rockii Diels, Notizbl. Bot. Gart. Berlin-Dahlem 9: 1030. 1926. TYPE: China. Yunnan Province: Mountains of Moting, NW of the Yangtze–Mekong watershed, June 1923, *J. F. Rock 10327* (holotype, presumably B, not seen; isotype, US).

Marmoritis decolorans (Hemsley) H. W. Li, comb. nov. Basionym: *Nepeta decolorans* Hemsley, Hooker's Icon. Pl. 25: t. 2470. 1896. *Glechoma decolorans* (Hemsley) Turrill, Bot. Soc. Exch. Club Brit. Isles 1919, 5: 695. 1920. *Phyllophyton decolorans* (Hemsley) Kudô, Mem. Fac. Sci. Taihoku Imp. Univ. 2: 225. 1929, "*decorans*." *Pseudolophanthus decolorans* (Hemsley) Levin, Trudy Bot. Inst. Akad. Nauk S.S.S.R., Ser. 1, Fl. Sist. Vyssh. Rast. 5: 296. 1941. TYPE: Hab. Central Tibet: Gooring Valley, 30°12′N, 90°25′E, at about 16,500 ft., *St. George Littledale*, July and Aug. 1895 (holotype, K not seen).

Marmoritis pharicus (Prain) H. W. Li, comb. nov. Basionym: *Nepeta pharica* Prain, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 59: 306. 1891. *Glechoma pharica* (Prain) Turrill, Bot. Soc. Exch. Club Brit. Isles 1919, 5: 695. 1920. *Phyllophyton pharicum* (Prain) Kudô, Mem. Fac. Sci. Taihoku Imp. Univ. 2: 225. 1929. *Pseudolophanthus pharicus* (Prain) Kuprianova, Bot. Zhurn. S.S.S.R. 33: 235. 1948. TYPE: Eastern Tibet, Phari, between Phari and Lhassa, *Lama Ujyen Gyatsko 106* (holotype, not seen).

Scutellaria yangbiensis H. W. Li, nom. nov. Replaced name: *Scutellaria urticifolia* C. Y. Wu & H. W. Li, Fl. Yunnan. 1: 545. 1977, non Juzepczuk & Vvedensky, Fl. URSS 20: 510. 1954. TYPE: Zhongdian Xian Expedition, NW Yunnan, *63-1020* (holotype, KUN).

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Two New Species of *Pleurothallis* (Orchidaceae) from the Amazonian Lowlands

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ABSTRACT. *Pleurothallis discophylla* and *P. erythrogramma* are described and illustrated. These new species are distributed in the Amazonian lowlands of Venezuela, Ecuador, Peru, and Bolivia. *Pleurothallis discophylla* has been previously misidentified in the literature as the Bolivian *Pleurothallis coffeicola*, which is almost certainly a synonym of the widespread *P. casapensis*.

The two following undescribed species are locally common and widespread in the western Amazon Basin. Both species are closely related and are characterized by a shortly creeping rhizome, sharply 3-winged ramicauls, broadly elliptic to suborbicular, spreading leaves, and yellow or orange flowers produced singly on short peduncles. Herbarium specimens of these plants have been frequently misidentified as *Pleurothallis coffeicola* Schlechter, a species described from Bolivia that is almost certainly conspecific with the frequent Andean species *Pleurothallis casapensis* Lindley.

Pleurothallis discophylla Luer & Carnevali, sp. nov. TYPE: Ecuador. Morona–Santiago: epiphytic in tall forest along Río Upano N of Macas, 1,100 m, 15 Jan. 1989, *C. Luer, J. Luer, P. & A. Jesup, A. Hirtz & S. Ortega 13927* (holotype, MO). Figure 1.

Species haec *P. casapensidis* Lindley affinis, sed foliis suborbicularis, pedunculis unifloris et labello pyriformi supra medium orbiculari tenui laevi differt.

Plant medium to large in size, epiphytic, shortly creeping, the rhizome stout, 0.5–3 cm long between ramicauls; roots slender. *Ramicauls* erect, 6–12 cm long, sharply 3-winged, slightly broader toward the leaf, with 2–3 thin, tubular sheaths at the base. *Leaf* spreading, coriaceous, broadly elliptical to suborbicular, obtuse, 4–7 cm long, 3–5 cm wide, sessile with the base ± cordate. *Inflorescence* a fascicle of peduncles, successively single-flowered, borne on top of the leaf, subtended by a spathe 5–7 mm long, from the apex of the ramicaul; peduncles 5 mm long; floral bract 3 mm long; pedicel 3 mm long; ovary cellular-glandular, 2.5 mm long. *Sepals* yellow to orange, brownish yellow or sometimes totally maroon, glabrous, the dorsal sepal linear-obovate, obtuse, thickened and subverrucose within toward the apex, 10–11.5 mm long, 3 mm wide, 3-veined, connate to the lateral sepals for 0.5 mm, the lateral sepals connate into an elliptical, bifid synsepal 9–10 mm long, 7 mm wide, 6-veined, the apex shallowly bifid with the tips acute and apiculate; *petals* translucent or yellow with a purple midvein, elliptical-obovate, obtuse, minutely serrulate, 3 mm long, 1.5 mm wide, with the vein thickened externally, ending in a minute apiculum; *lip* yellow to orange or purple-brown with brownish yellow margin, obovate-pyriform in outline, 5 mm long, 3.5 mm wide, the apex broadly rounded, entire, thin, smooth, the margins above the base erect, rounded, the disk minutely spiculate near the middle, with a pair of parallel, subverrucose calli on the middle third, the base thickened, truncate, hinged to the tip of the column-foot; *column* semiterete, winged above the middle, 3 mm long, minutely toothed at the apex, the foot 2 mm long, the anther, rostellum, and stigma ventral.

Etymology. From the Greek *discophyllos*, "round-leaved," referring to the broad, flat leaves.

This species is closely related to the frequent *Pleurothallis casapensis*, but *P. discophylla* is found in warm forests at altitudes below 1,200 m. It is distinguished by the creeping rhizome, erect, sharply triquetrous ramicauls; spreading suborbicular leaves;

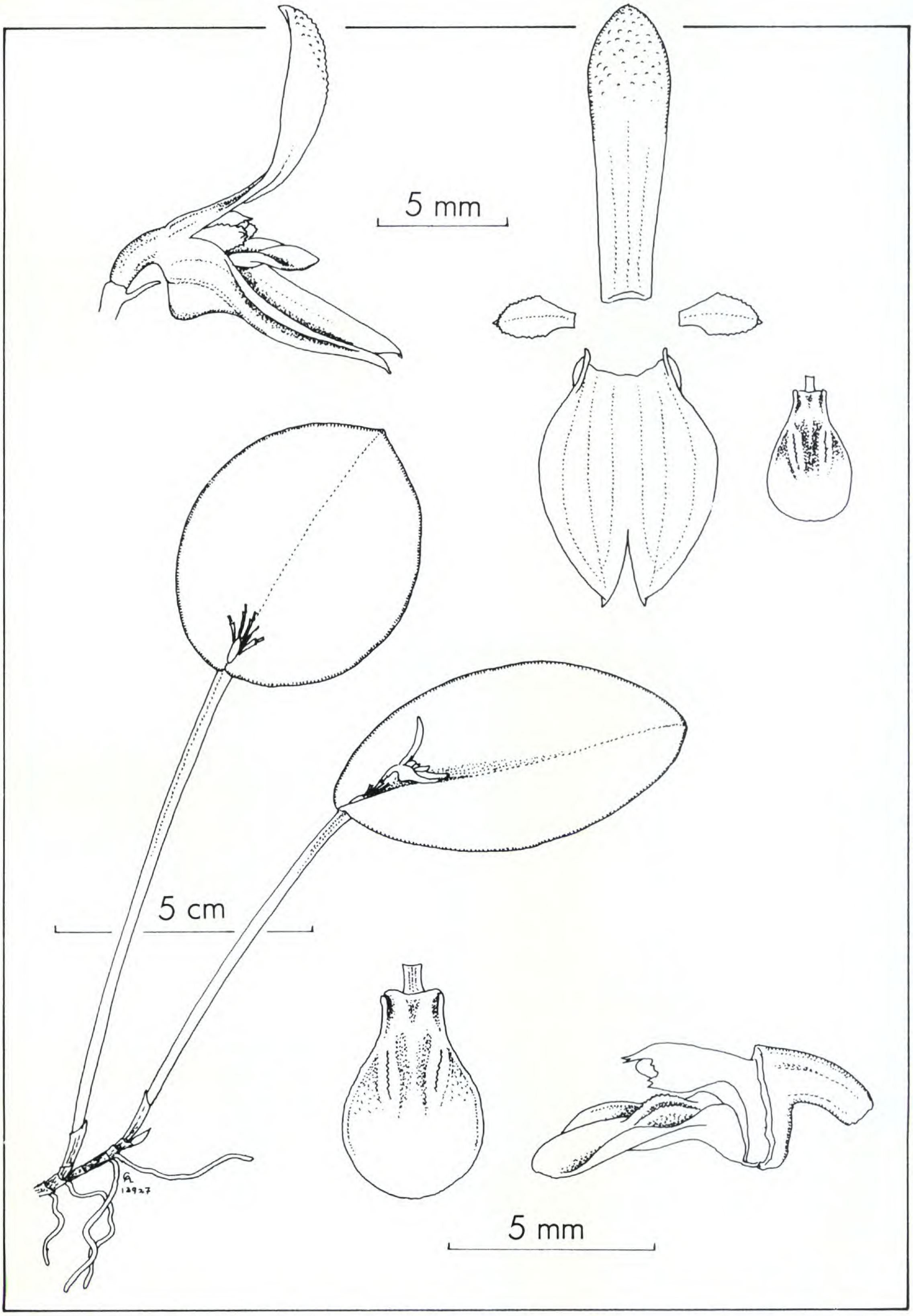

Figure 1. *Pleurothallis discophylla* Luer & Carnevali.

and relatively large, yellow to orange flowers produced singly. The dorsal sepal is erect, thickened, and subverrucose toward the apex. The lateral sepals are connate into a broad, shallowly bifid lamina. The petals are minutely serrulate. The lip is pyriform in outline, broadly rounded, dilated and thin above the middle with smooth margins and surface. Above the base the margins are erect. A pair of subverrucose calli are present below the middle of the disk where the surface is minutely spiculate.

Several authors have misidentified material of this species as *Pleurothallis coffeicola* (Schweinfurth, 1967; Foldats, 1970). An illustration of this species from lowland Venezuela was also misidentified as *Pleurothallis coffeicola* in *Venezuelan Orchids Illustrated* (Dunsterville & Garay, 1972). *Pleurothallis coffeicola* is a smaller plant that produces several flowers in a raceme and occurs at higher altitudes. It is very probably conspecific with *P. casapensis*. The closest relative of *Pleurothallis discophylla* is probably the following species.

Paratypes. ECUADOR. **Napo:** La Cruz, downstream from Misahualli, 400 m, collected by C. & A. Suárez, flowered in cultivation, 29 Mar. 1984, *Luer 9784* (MO). PERU. **Amazonas:** Río Cenepa, vicinity of Huampami, ca. 4°30′S, 78°30′W, 200–250 m, 1 Aug. 1978, *Kujikat 94* (MO). **Loreto:** Maynas, Mishana, 73°35′W, 03°55′S, primary forest at 130 m, 21 July 1984, *Vázquez, Jaramillo & Criollo 5305* (MO); Distrito Iquitos, km 8 Carretera Quisto Cocha-Varillal, perched forest over sand, 130 m, 24 July 1984, "epiphytic," *S. MacDaniel & M. Rimachi 27836* (MO). BOLIVIA. **Cochabamba:** epiphytic in seasonally dry forest, Bulo-Bulo, W of Yapacaní, 300 m, 22 Aug. 1991, *C. Luer, J. Luer, R. Vásquez & D. Ric 15343* (MO). VENEZUELA. **Territorio Federal Amazonas:** Departamento Atabapo, slopes of Cerro Marahuaca, "Sima" area, 03°43′N, 65°30′W, 1,200 m, 19 Oct. 1988, *Liesner 25077* (MO, VEN); Cerro Marahuaca, Sima Camp, 1,140 m, 21–22, 24 Feb. 1985, "common epiphyte," *Steyermark & Holst 130474* (MO, VEN), *Steyermark & Holst 130657* (MO, VEN); Departamento Casiquiare, flooded forest along uppermost Río Yatúa, 100–140 m, 7–8 Dec. 1953, *Maguire, Wurdack & Bunting 36730* (NY), 12 Dec. 1953, *Maguire, Wurdack & Bunting 36763* (NY, VEN), 30–31 Dec. 1954, *Maguire, Wurdack & Bunting 37430* (NY); tall forest near river's edge at Caño Pato, 150 m, Dec. 1965, *Dunsterville & E. Dunsterville 966* (AMES, VEN); Departamento Río Negro, between Caño Temblador and Hauchica, 10 km NE of San Carlos de Río Negro, 120 m, 1°67′N, 67°03′W, 19 Nov. 1977, *Liesner 3672* (MO, VEN); Caño 12 km NE of San Carlos de Río Negro, 1°56′N, 67°03′W, 120 m, 15 Apr. 1979, "epiphyte on Lecythidaceae, forest over white sand," *Liesner 6659* (MO, VEN).

Pleurothallis erythrogramma Luer & Carnevali, sp. nov. TYPE: Ecuador. Napo: epiphytic in trees along Río Cascales E of Lumbaqui, 450 m, 9 Feb. 1986, *C. Luer, J. Luer, Hirtz, Flores & Embree 11766* (holotype, MO). Figure 2.

Species haec *P. casapensidis* Lindley affinis, sed foliis suborbicularis, pedunculis unifloris, synsepalo rubrolineato et labello elliptico denticulato differt.

Plant medium in size, epiphytic, shortly repent, the rhizome stout, 0.5–1 cm long between ramicauls; roots slender. *Ramicauls* erect, 6–8 cm long, sharply 3-winged, slightly broader toward the leaf, with 2–3 thin, tubular sheaths at the base. *Leaf* spreading, coriaceous, broadly elliptical to suborbicular, obtuse, 3.5 cm long and 3.5 cm wide to 4.5 cm long and 4.5 cm wide, sessile with the base cordate or subcordate. *Inflorescence* a fascicle of successive, single-flowered peduncles, borne on top of the leaf, subtended by a broad spathe 2–3 mm long and broad, from the apex of the ramicaul; peduncles 1–2 mm long; floral bract 4 mm long; pedicel 6 mm long; ovary 2.5 mm long. *Sepals* yellow, prominently veined in red, fleshy, glabrous, the dorsal sepal linear, acute, thickened at the apex, 13.5 mm long, 2 mm wide, 3-veined, free from the lateral sepals; lateral sepals connate into an ovate, acute synsepal 10 mm long, 6.5 mm wide, 6-veined, the apex shallowly bifid with the tips acute and apiculate; *petals* translucent, obovate, acute or obtuse, minutely serrate, 3 mm long, 1 mm wide, 1-veined; *lip* red, elliptical, 5.5 mm long, 2.5 mm wide, the apex narrowly obtuse, denticulate, the margins in the lower third broadly rounded, the disk with a pair of verrucose calli within the margins of the lower third, the base narrowly truncate, hinged to the base of the column-foot; *column* semiterete, winged above the middle, 3.5 mm long, minutely toothed at the apex, the foot 2 mm long, the anther, rostellum and stigma ventral.

Etymology. From the Greek *erythrogramme*, "red-line," referring to the stripes of the synsepal.

This pretty species is known from the lowlands of eastern Ecuador and Peru. It is closely allied to the sympatric *P. discophylla*. Both species are deceptively alike vegetatively and produce similar flowers singly, but *P. erythrogramma* is distinguished by the red-striped sepals with the dorsal sepal conspicuously long and narrow. The red lip is elliptical and minutely crested and denticulate.

Paratypes. ECUADOR. **Morona–Santiago:** between Misión Bomboiza and Gualaquiza, ca. 850 m, 30 Jan. 1971, *B. MacBryde 170* (MO). PERU. **Amazonas:** epiphytic in primary forest S of Aintami, E of Cenepa, 650 ft., 15 July 1974, *B. Berlin 1605* (MO).

KEY SUMMARIZING THE DIFFERENCES BETWEEN THE TWO NEWLY DESCRIBED SPECIES

1a. Dorsal sepal linear-obovate, obtuse, subverrucose within toward the apex; synsepal broader

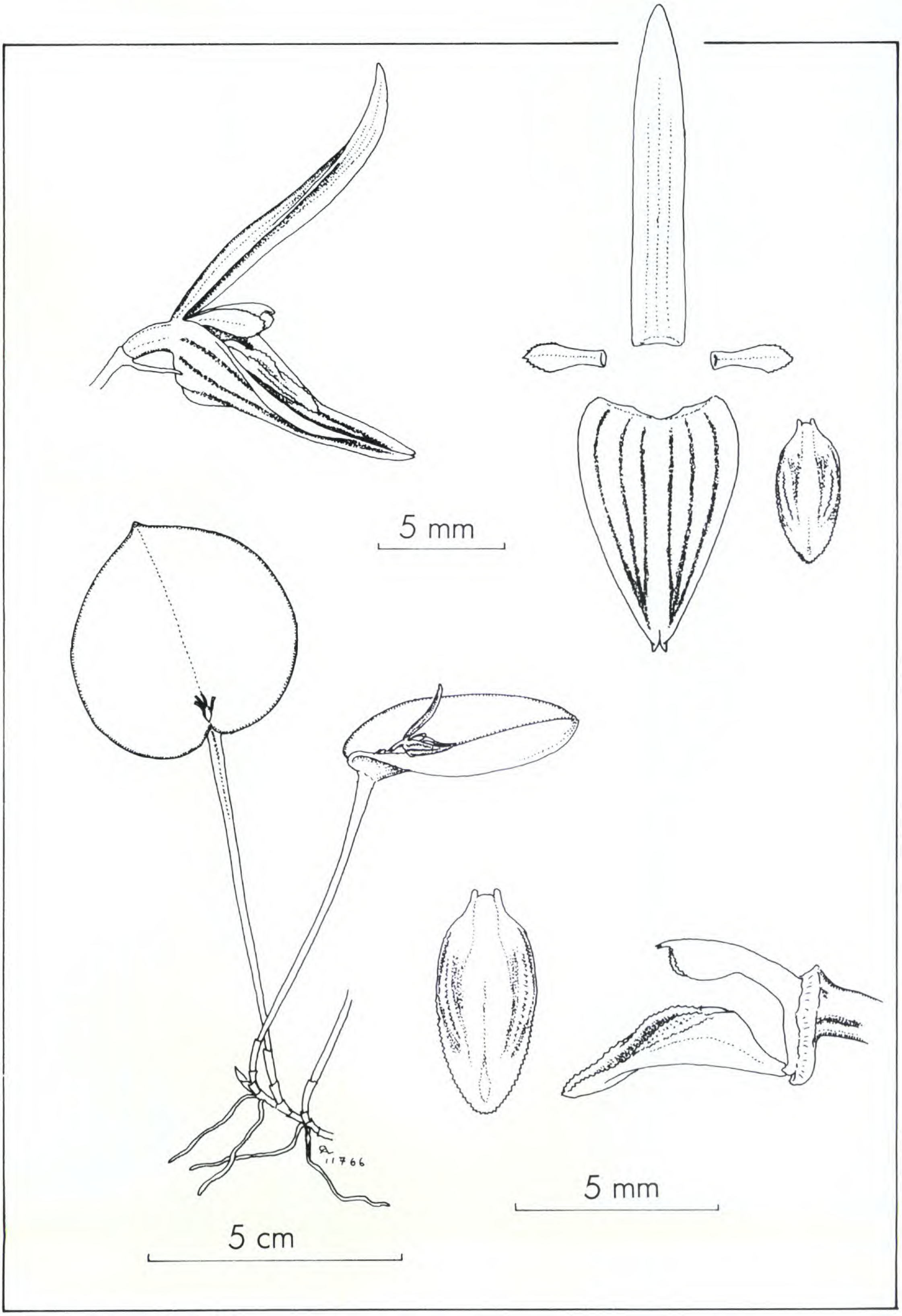

Figure 2. *Pleurothallis erythrogramma* Luer & Carnevali.

toward the middle; petals elliptical-obovate; lip yellow to orange or purple-brown with brownish yellow margin, obovate-pyriform, margins entire, disk smooth or minutely spiculate, ca. 3.5 mm wide; sepals yellow to orange, brownish yellow or totally maroon, nonstriped; spathe 5–7 mm long ..... *Pleurothallis discophylla*

1b. Dorsal sepal linear, acute, smooth within; synsepal broader toward base; petals obovate; lip red, elliptical, margins denticulate, disk with a pair of verrucose calli, ca. 2.5 mm wide; sepals yellow with red stripes or veins; spathe 2–3 mm long ..... *Pleurothallis erythrogramma*

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Foldats, E. 1970. *Pleurothallis coffeicola.* Flora Venez. 15(2): 245–246.

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New Names for Two Elaphoglossums

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ABSTRACT. New names are proposed for two recently described species of *Elaphoglossum* whose epithets had already been used.

Elaphoglossum killipianum Mickel, new name for *E. killipii* Mickel, Novon 2: 376. 1992, not *E. killipii* Mickel in R. M. Tryon & R. G. Stolze, Fieldiana, Bot., n. s. 27: 138. 1991.

Elaphoglossum lanigerum Mickel, new name for *E. lanatum* Mickel in R. M. Tryon & R. G. Stolze, Fieldiana, Bot., n. s. 27: 139. 1991, not *E. lanatum* (Bojer ex Baker) Lorence, Fern Gaz. 11: 199. 1976.

NOVON 3: 163. 1993.

Four New Taxa and One Rediscovered Species of *Mouriri* (Melastomataceae)

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ABSTRACT. Three new species of *Mouriri* from midwestern and southwestern Colombia and eastern Brazil are described and illustrated, as is a new subspecies of *Mouriri grandiflora* from western Amazonia. *Mouriri tessmannii*, its type and only known specimen destroyed at Berlin, has been recollected and is redescribed and illustrated.

Mouriri colombiana Morley, sp. nov. TYPE: Colombia. Antioquia: Municipio de San Luís, Cañon del Río Claro, sector norte, margen derecha, 5°53′N, 74°39′W, 3 June 1984, *Alvaro Cogollo 1796* (holotype, COL; isotypes, JAUM, MO). Figure 1.

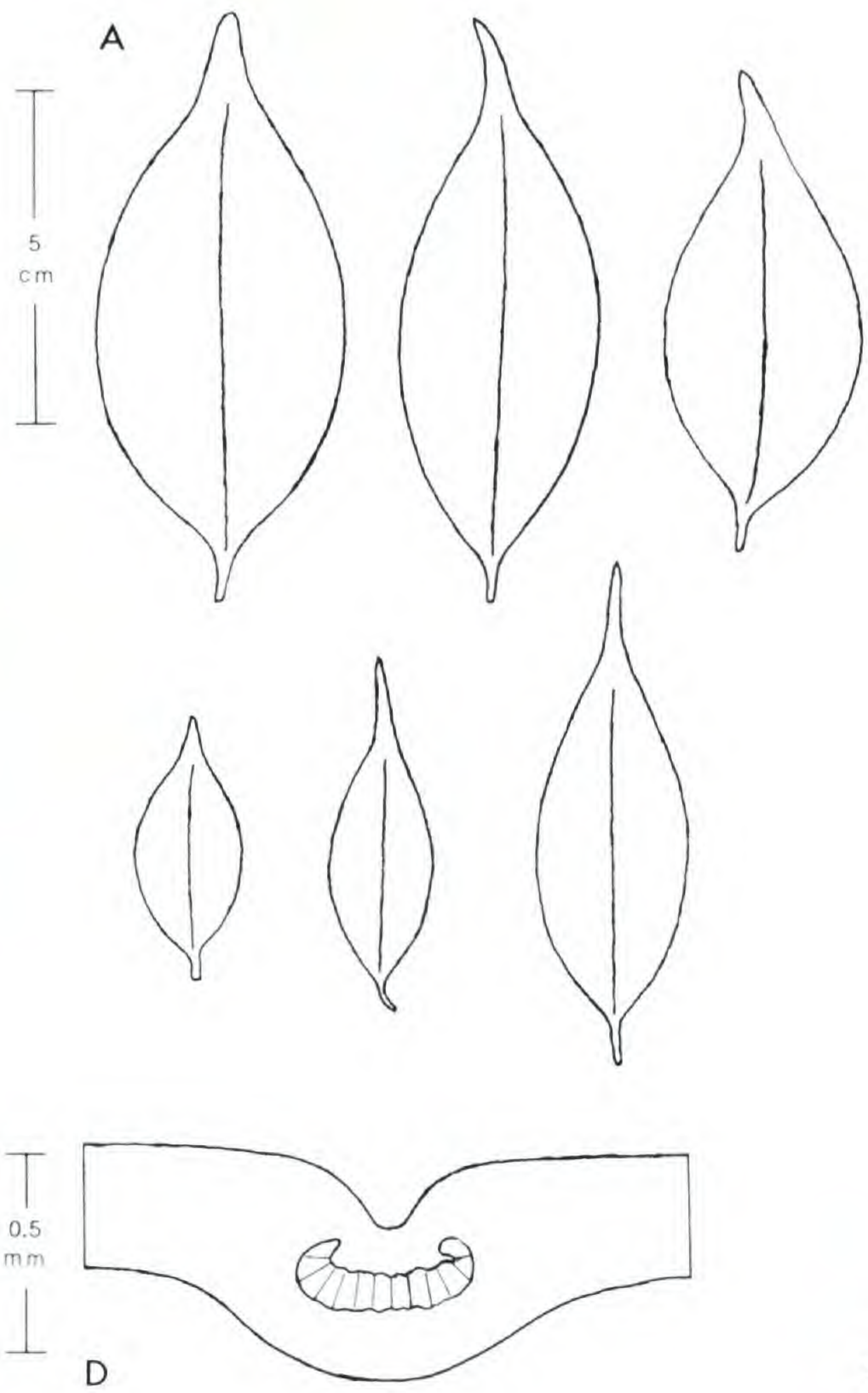
Arbor usque 26 m alta; laminae 2.9–8.6 cm longae, 1.8–3.5 plo longiorae quam latiorae; cryptae stomatophorae nullae, hypodermis absens; pedunculi plerumque 1-flori, pedicelli 0.8–3.5 mm longi; calyx 0.5–0.8 mm findens inter lobos sub anthesi, lobis 1–1.3 mm longis ab staminibus; antherae 3.4–4.1 mm longae, thecae 2.5–3.3 mm longae, rimis apicalibus dehiscentes; ovarium 1-loculare, ovula 8–11; fructus globosus exterio viscosissimo; semina 1 vel fortasse 2, ca. 22 mm alta, 24 mm lata, 11 mm crassa.

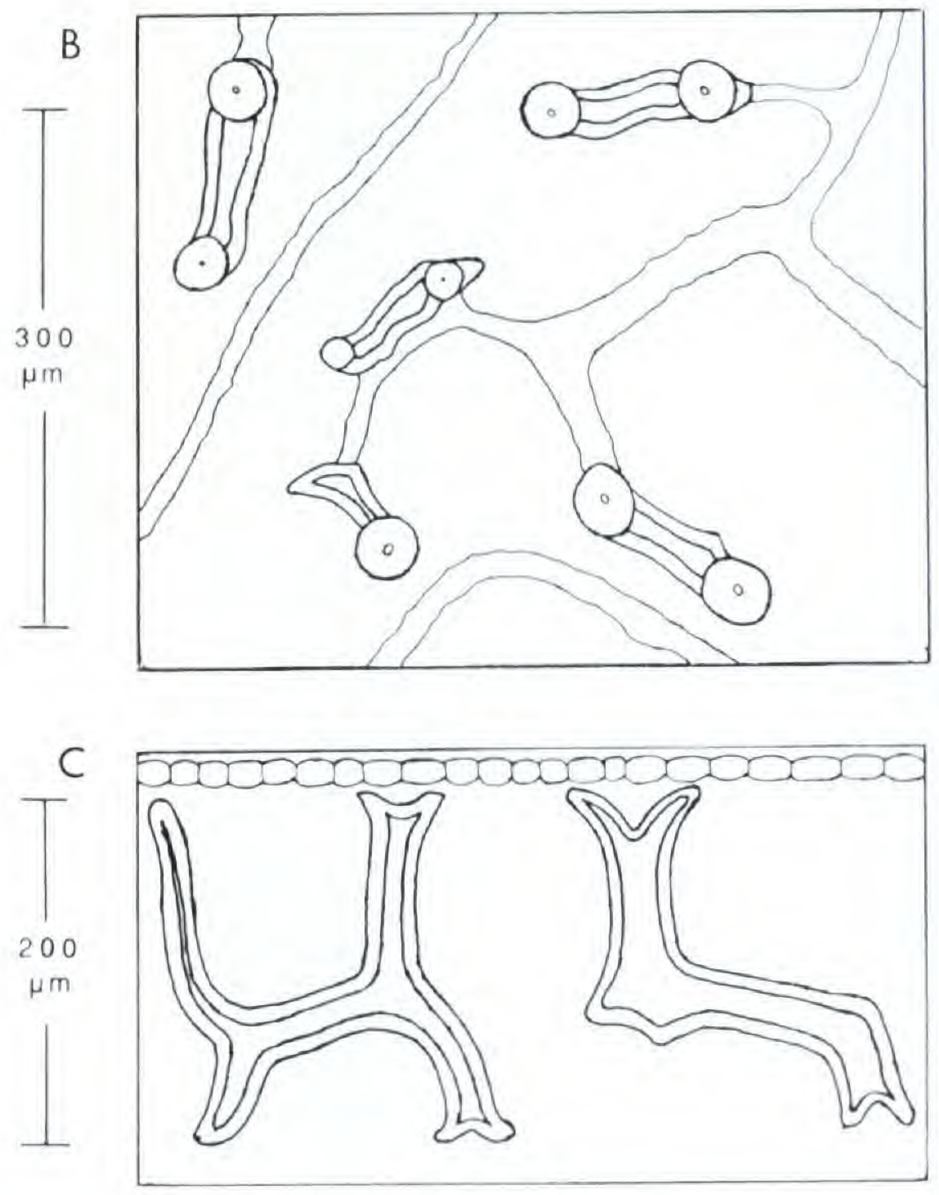
Glabrous tree to 26 m high; young twigs rounded. Petioles 3–6 mm long; blades 2.9–8.6 cm long, 1.4–3.8 mm wide, 1.8–3.5 times as long as wide, elliptic to ovate-elliptic or narrowly so, acuminate to abruptly so to caudate at apex, acute and abruptly attenuate at base; midrib grooved above, low-rounded below; lateral nerves slightly visible to invisible above and below when dry; leaves drying dark olive green to black. Midrib xylem open above; stomatal crypts none; upper epidermis one cell thick, lacking mucilaginous walls; hypodermis none; crystals occasional in the upper spongy parenchyma; terminal sclereids stellate with a strong columnar tendency, often with a horizontal central body 2–8 times as long as wide with a columnar extension at each end, sometimes entirely columnar, the columnar parts branching at the epidermis. Flowers axillary and terminal, the peduncles one or two per axil, each 1- or rarely 2- or 3-flowered, 0.5–4 mm long to base of pedicel measured along the axis with (1–)2(–3) internodes in that length; bracts 0.7–1.5 mm long, ovate-triangular, acute, persistent in fruit or deciduous. Flowers pentamerous; true pedicels 0.8–3.5 mm long; calyx including inferior ovary 4–5 mm long, obconic to campanulate; free hypanthium 2.3–2.5 mm long; calyx lobes before anthesis low-rounded and sometimes with a very small apiculum, 0.2–0.4 mm long, 1.2–1.4 mm wide, 1–1.3 mm long when measured from the stamen attachment, the calyx splitting between the lobes at anthesis a distance of 0.5–0.8 mm, the lobes then 1.7–2.2 mm wide. Petals yellow, 10–11 mm long, 3.5–4 mm wide, narrowly ovate-triangular, acuminate, with a short claw at base. Antesepalous filaments 6.5–7 mm long, antepetalous ones 8–9 mm long; anthers yellow-orange, 3.4–4.1 mm long; thecae 2.5–3.3 mm long, dehiscing by apical slits; gland 0.4–0.8 mm long, 1.3–1.9 mm from apex of anther when measured from center of gland; cauda 0.8–1 mm long. Ovary 1-locular but with a half partition, the ovules technically axile, 8–11; style 13–15 mm long. All flower parts drying blackish except for the anthers. Fruits globose, bearing the remains of the calyx, 23–40 mm diam. when dry, estimated 27–50 mm when fresh, then covered with a sticky transparent resin, green to greenish yellow. Seeds 1 or sometimes 2, roughly half spherical, 16–28 mm wide, one studied, this 22.2 mm high, 24 mm wide, 11 mm thick, with an irregular polished area at the base of the outer face 13 mm long by 8 mm wide, the remainder of the outer face irregularly grooved or wrinkled.

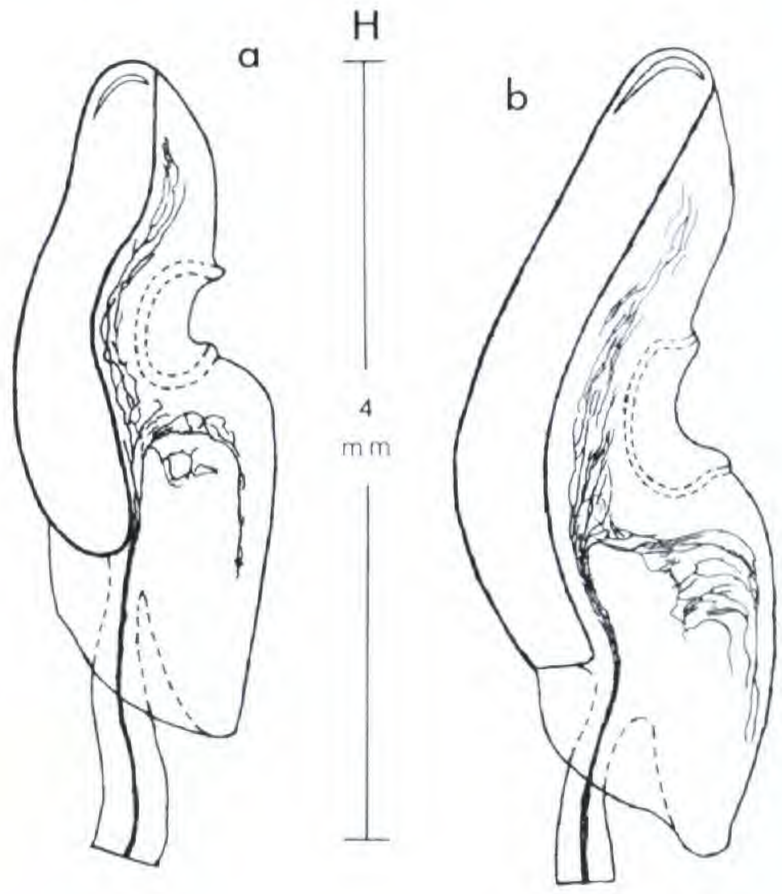
Distribution. Known only from an area in southern Antioquia, Colombia, about one-third of the way from Medellín to Bogotá.

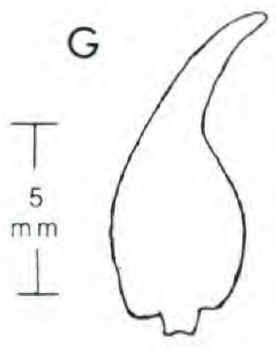
→

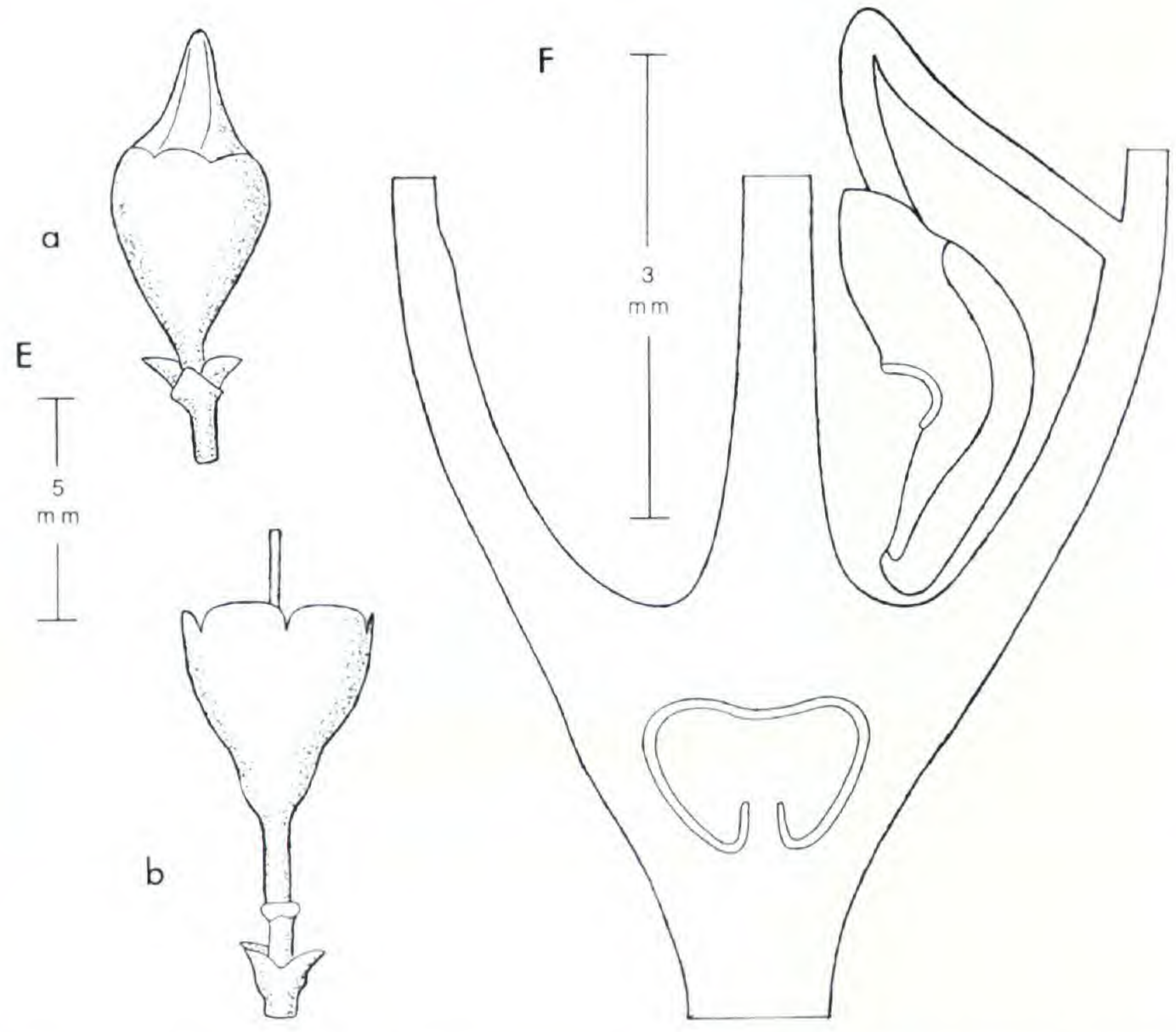
Figure 1. *Mouriri colombiana* Morley. —A. Leaves from various collections. —B. Cleared part of leaf blade showing veins and terminal sclereids. —C. Cross section of leaf blade showing sclereids and upper epidermis. —D. Cross section of leaf midrib. —E. Flowers: a, before anthesis (*Renteria 2797*); b, at anthesis (*Cogollo 1796*). —F. Longisection of flower before anthesis. —G. Petal. —H. Anthers, cleared to show veins inside: a, *Renteria 2797*;

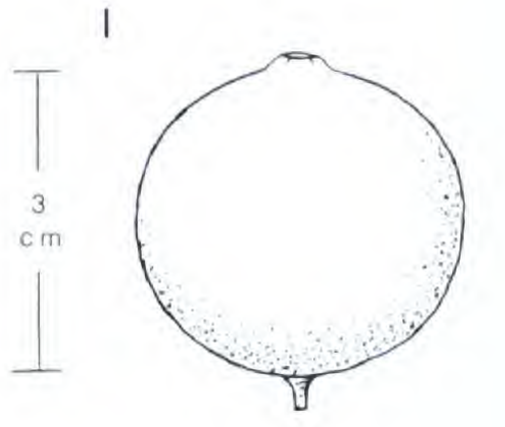












b, *Cogollo 1796*. —I. Fruit (*Cogollo 1434*). —J. Seed, showing the hour-glass-shaped polished surface of the outer face (*Cogollo 1434*). (B, C, D, F, and G are *Cogollo 1796*.)

TABLE 1. *Mouriri colombiana* compared with the three most similar species in its section.

	M. colombiana	*M. collocarpa*	*M. oligantha*	*M. pauciflora*
Leaf l/w ratio	1.8–3.5	1.6–2.5	1.7–2.9 (–3.1)	(2.1–) 2.6–4.3
Hypodermis	absent	present	present	present
Number of flowers	1 (–3)	(1–) 3–15	1	1
Ovary + calyx length (mm)	4–5	3.8–6	4.8–7	5–8
Calyx lobe length from stamen (mm)	1–1.3	1–1.9	2.1–4	1.8–3.5
Calyx splitting distance (mm)	0.5–0.8	1–1.4	2–3	(1.2–) 2–3
Anther length (mm)	3.4–4.1	2.1–2.6	2.4–4.4	2.4–4.4
Theca length (mm)	2.5–3.3	1.6–2.3	2.1–2.8	2–3.2
Apical slit dehiscence	present	present	absent	absent
Gland length (mm)	0.4–0.8	0.8–1.4	1.1–1.9	0.6–1
Number of locules	1	3–5	3–4	2
Number of ovules	8–11	12–15	9–12	6–9

Mouriri colombiana is clearly placed in subgenus *Taphroxylon* sect. *Taphroxylon* because of the midrib xylem, which is open above, the evergreen leaves lacking stomatal crypts, the axile placentation, and the long anther thecae, which extend well below the gland. Its affinity to plants of the above section was first recognized by A. Cogollo, who identified his collections *1254* and *1434* as being related to *M. collocarpa* Ducke. In its section, *M. colombiana* is most readily distinguished from *M. trunciflora* Ducke by the latter's numerous ovules, compared to the 8–11 of the new species. The next most easily eliminated species is the widespread *M. acutiflora* Naudin, from which *M. colombiana* differs in lacking a hypodermis and in having the flowers mostly borne singly, and in its darker colors on drying, apical slit dehiscence of the anthers, and larger seeds. The remaining three species of the group are compared with the new one in Table 1. *Mouriri colombiana* is best distinguished from *M. collocarpa* by the former's lack of a hypodermis, mostly single flowers, short splitting distance of the calyx, longer anthers and thecae, and single ovary locule; from *M. oligantha* Pilger by the narrow leaves, lack of a hypodermis, short calyx lobes, short splitting distance, apical slit dehiscence, and single locule; and from *M. pauciflora* Spruce ex Triana by the lack of a hypodermis, short calyx lobes and splitting distance, apical slit dehiscence, and somewhat larger number of ovules. The half partition in the ovaries examined suggests that a full partition might sometimes occur, giving the two locules also found in *M. pauciflora*. *Mouriri colombiana* appears to combine several relatively unmodified characters with advanced ones. Examples of the former are the lack of a hypodermis in the leaf and the short calyx lobes with their short splitting distance. Advanced features are the mostly single flowers, the unusual anther shape, which resembles that of *M. pauciflora*, the theca's apical slit dehiscence, the single ovary locule, and small number of ovules.

Paratypes. COLOMBIA. **Antioquia:** Río Claro, margen izquierda, 600 m, 16 Sep. 1982 (buds), *E. Rentería & A. Cogollo 2705* (JAUM, MO); Alto Rico, 9 Oct. 1982 (buds), *E. Rentería, A. Cogollo & C. Estrada 2797* (JAUM, MO); Autopista Medellín–Bogotá, sector Río Samaná–Río Claro, camino hacia la vereda La Primavera, 790 m, 13 Nov. 1982 (fr), *A. Cogollo & C. C. Estrada 227* (JAUM, MO), 2 km antes de la Josefina, zona muy perturbada, quebrada la salada, 800 m, 22 Sep. 1983 (fr), *S. E. Hoyos & J. J. Hernández 378* (JAUM, MO); margen izquierda, 325 m, 3 May 1984 (fr), *A. Cogollo 1683* (JAUM, MO); sector nor-occidental, margen izquierda 325–500 m, 8 Mar. 1984 (fr), *A. Cogollo 1434* (JAUM, MO), 28 Jan. 1984 (fr), *A. Cogollo 1254* (JAUM, MO); municipio de San Luis, quebrada "La Cristalina," 6°N, 74°45′W, Bh-T/Bmh-T, Sector NW, 470–580 msnm, 4 Dec. 1986 (fr), *J. G. Ramírez & D. Cárdenas Lopez 234* (MO), 700–550 msnm, 22 Jan. 1987 (fr), *368* (MO), Sector SE, 770–570 msnm, 23 Feb. 1987 (fr), *624* (MO), 770–500 msnm, 23 Mar. 1987, (fr) *719* (MO), 770–570 msnm, 24 Sep. 1987 (fl buds), *1616* (MO), 27 Oct. 1987 (fr), *1871*, *1880* (MO), Carretera de Monteloro al Corregimiento el "Prodigo," 6°4′N, 74°50′W, 950–600 msnm, 8 Mar. 1990 (fr), *D. Cardenas L. & J. G. Ramirez 2578* (MO).

Mouriri impressinerva Morley, sp. nov. TYPE: Colombia. Nariño: 40 km E of Tumaco near Ecuador border, 50 m alt., moist forest S of Río Mira, 24 Nov. 1981, *A. Gentry et al. 34902* (holotype, COL; isotype, MO). Figure 2.

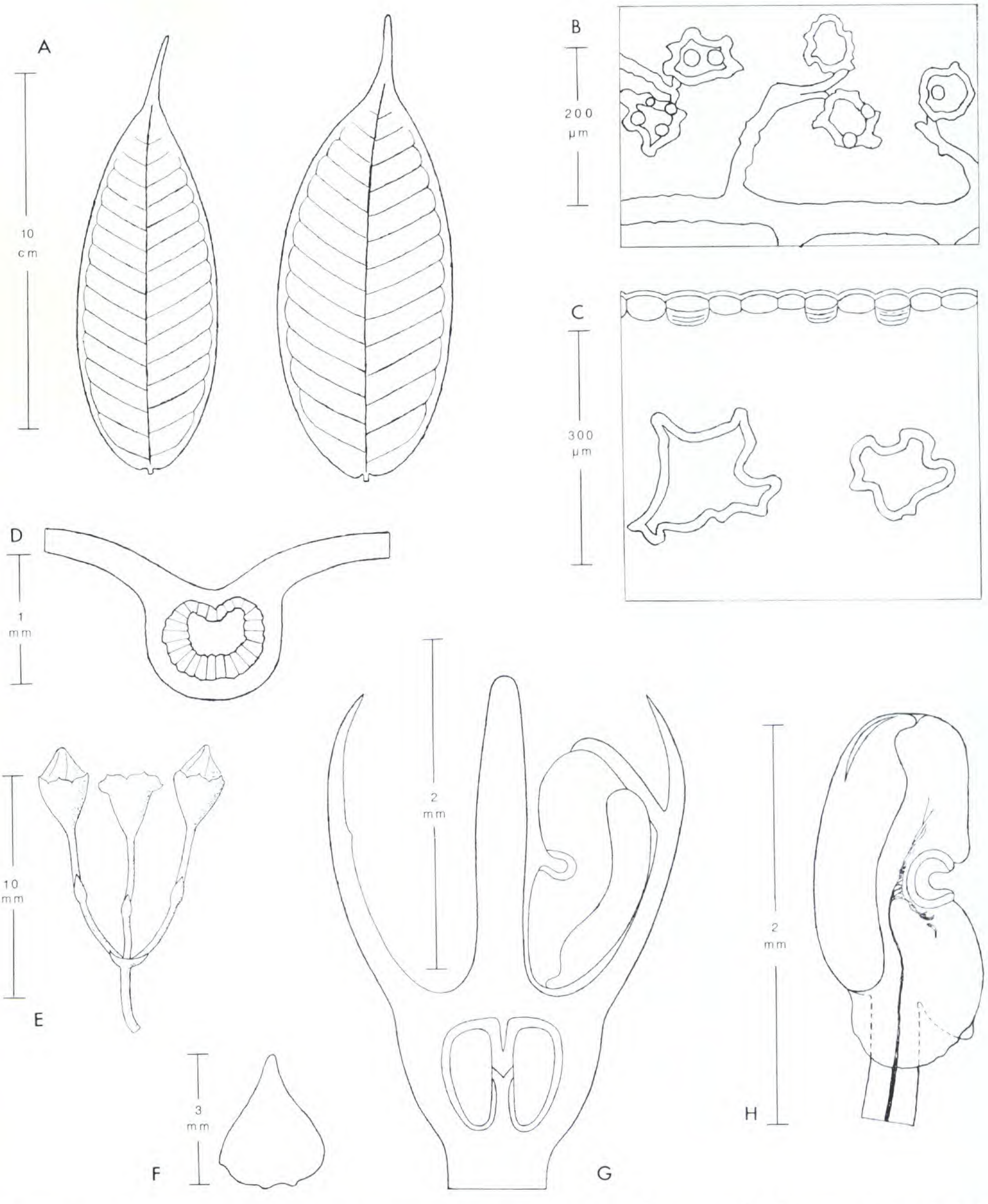
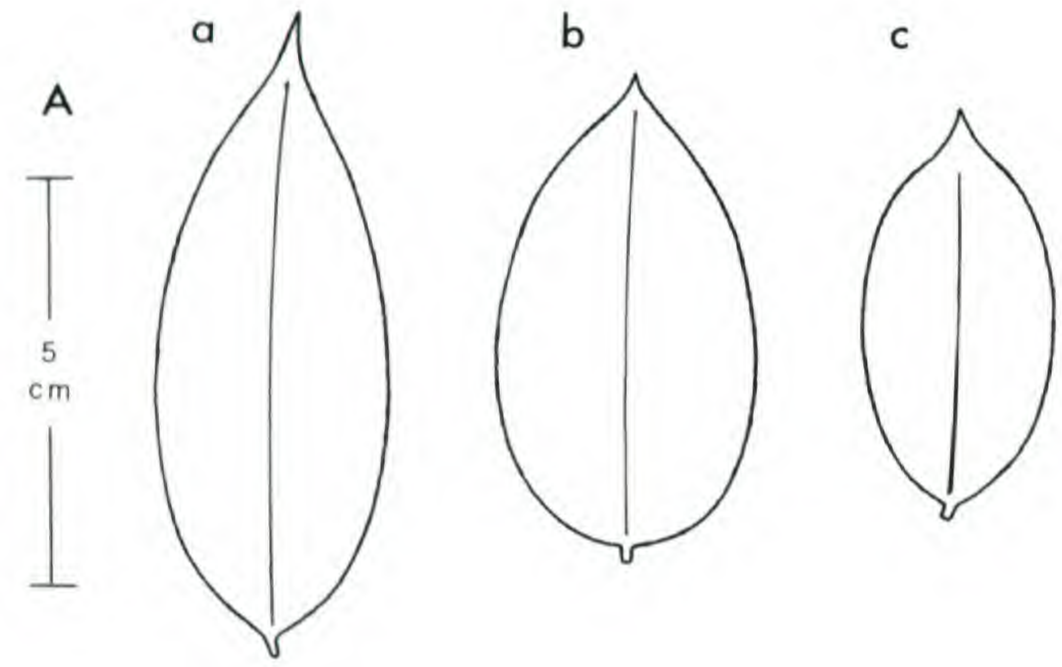
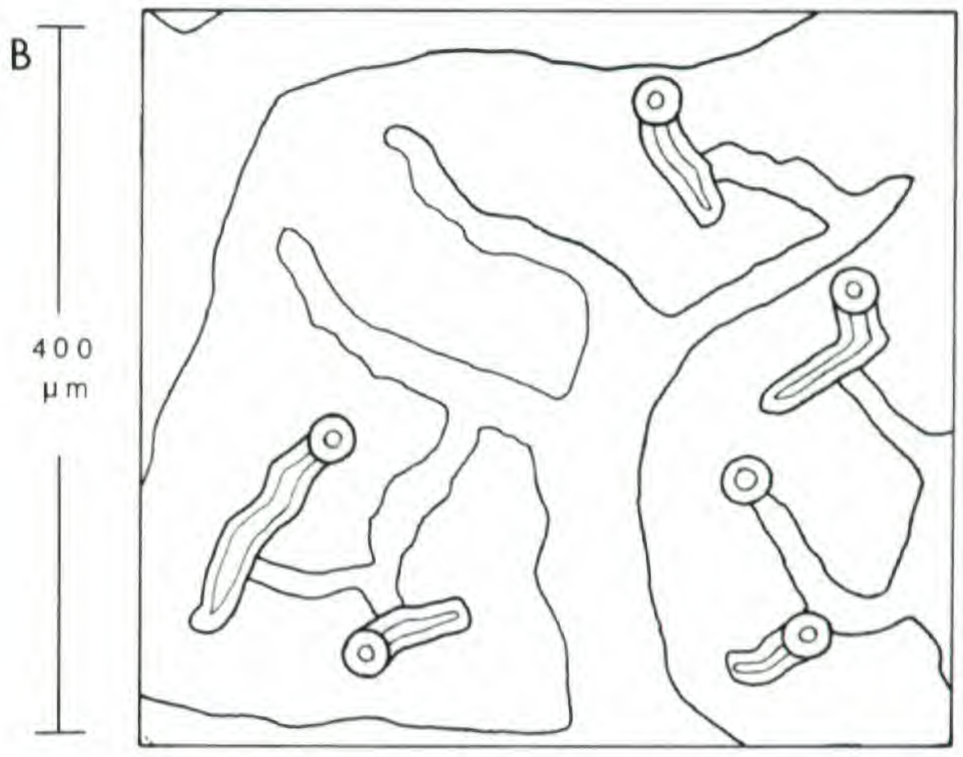


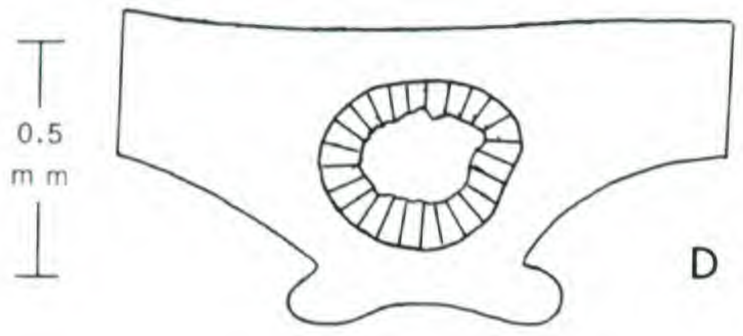
Figure 2. *Mouriri impressinerva* Morley (*Gentry et al. 34902*). —A. Leaves. —B. Cleared part of leaf blade showing veins and terminal sclereids. —C. Cross section of leaf blade showing sclereids and upper epidermis. —D. Cross section of leaf midrib. —E. Inflorescence. —F. Petal. —G. Longisection of flower before anthesis. —H. Anther, cleared to show the veins.

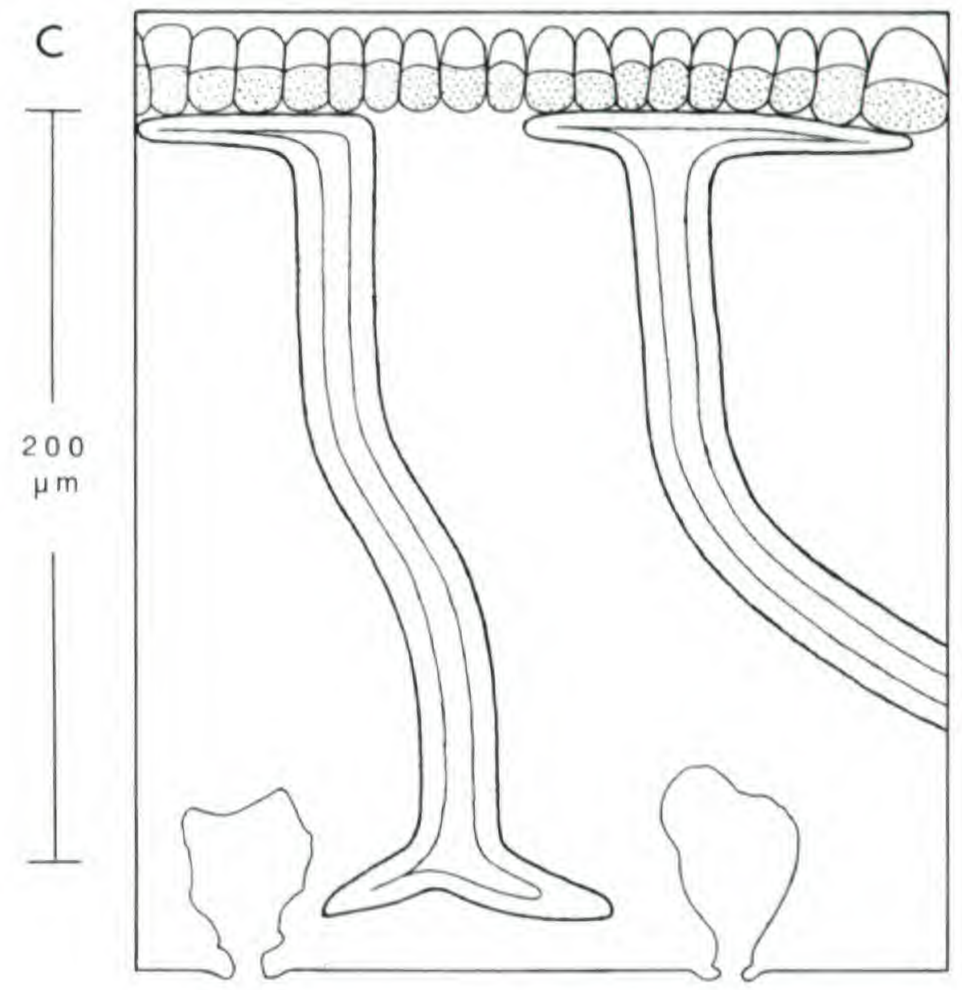
Arbor usque 4 m alta; laminae 12–18 cm longae, basi cordata incisura 0.5–1 mm profunda; superficies costae et nervorum lateralium sulcatae, paginae inferiores prominentes; cryptae stomatophorae nullae, hypodermis absens, sclerides terminales foliorum rectangulares usque sphaericae; pedicelli 3–6 mm longi; calyx ovarium includens 2.7–3 mm longus; antherae 1.4–1.9 mm longae, thecae 1.2–1.5 mm longae; ovarium incomplete 2-loculare, ovula 6–7.

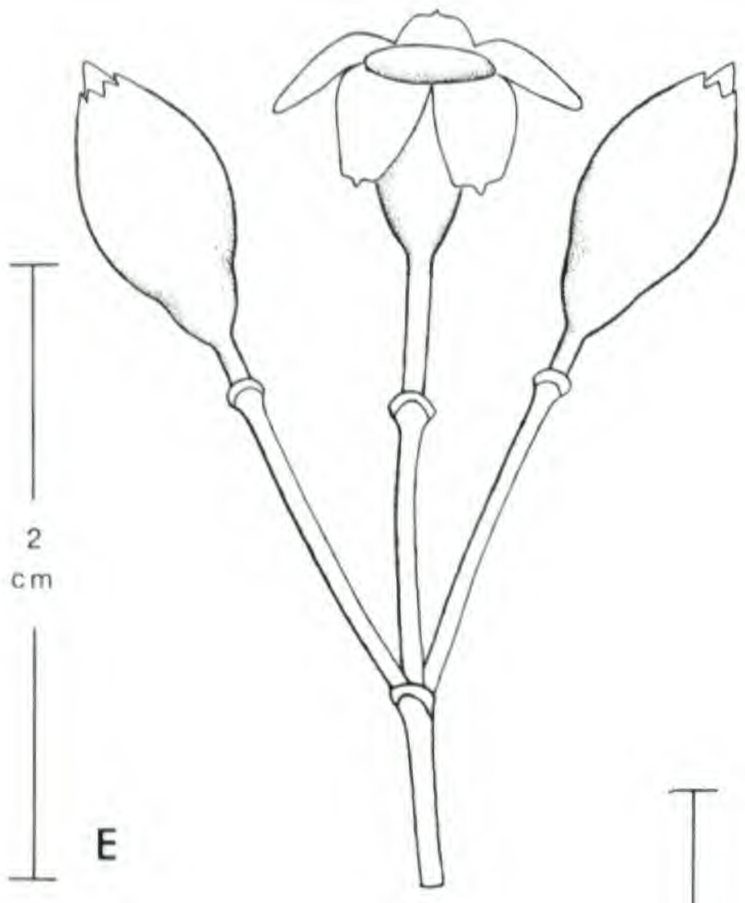
Glabrous tree 4 m high; young twigs narrowly 4-winged. Petioles 1–2 mm long; blades 12–18 cm long, 3.8–7.5 cm wide, elliptic to ovate-elliptic,

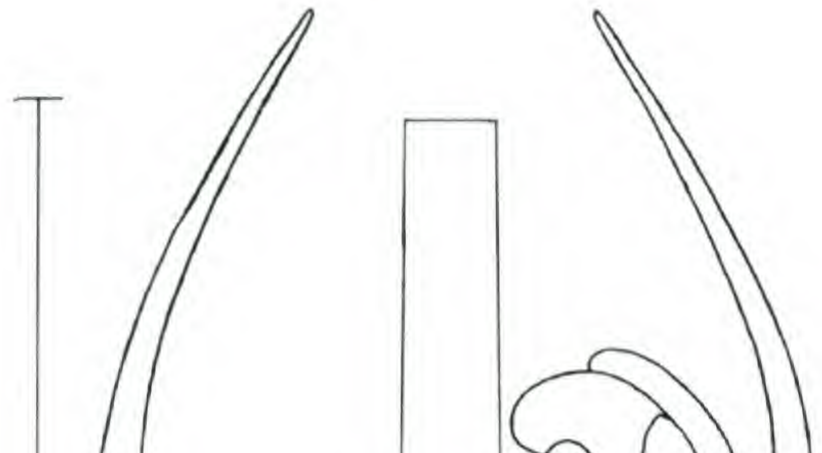


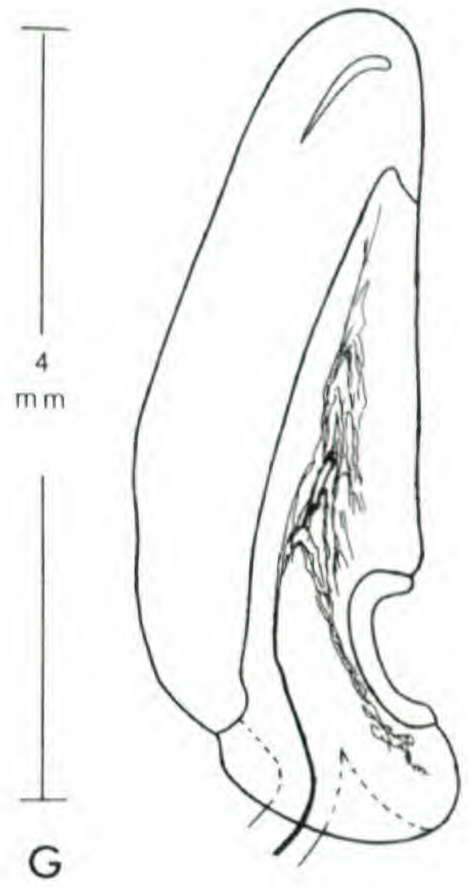












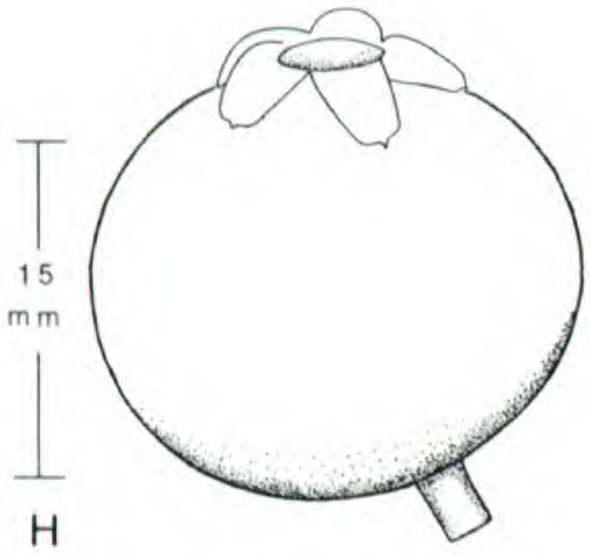


Figure 3. *Mouriri arenicola* Morley. —A. Leaves (a, b, *Araujo et al. 8343;* c, *Araujo et al. 8335*). —B. Cleared part of leaf blade showing veins and terminal sclereids. —C. Cross section of leaf blade showing sclereids, stomatal crypts, and upper epidermis. —D. Cross section of leaf midrib. —E. Inflorescence (composite of *Araujo et al. 8335*

abruptly caudate at apex, rounded to a shallowly cordate base, the notch 0.5–1 mm deep; midrib grooved above, prominent below and rounded near the base, becoming somewhat 2-angled at the middle and beyond; lateral nerves conspicuous, grooved above with marginal arcuate connecting nerves plane or slightly grooved, the lateral and marginal nerves prominent below. Midrib xylem tubular, depressed in the center above; stomatal crypts none; upper epidermis 1 cell thick with occasional cells with mucilaginous walls in which a few delicate layers are visible; hypodermis none; terminal sclereids rectangular to spherical, mostly 1–1.5 times as long as wide, with numerous short arms; all leaf tissues filled with tannin compounds. Flowers axillary and at leafless nodes of twigs to 6 mm thick; peduncles 1–3 per side, 1–3-flowered, 1.5–7.5 mm long to base of most distal pedicel with 1 or 2 internodes in that distance; bracts 1–2 mm long, ovate-triangular to narrowly so, variously deciduous after anthesis. Flowers pentamerous; true pedicels 3–6 mm long; calyx including inferior ovary 2.7–3 mm long, obconic at anthesis; free hypanthium 1.3–1.4 mm long; calyx lobes 0.3–0.4 mm long, 1.2–1.3 mm wide, truncate and apiculate, 0.4–0.6 mm long when measured from the stamen attachment; calyx not splitting between lobes at anthesis. Petals pink, triangular, broadly rounded at base, 2.4–3.3 mm long, 1.7–2.5 mm wide. Filaments unknown; anthers 1.4–1.9 mm long; thecae 1.2–1.5 mm long, dehiscing by apical slits; gland 0.1–0.3 mm long, 0.7–0.9 mm from apex of anther when measured from center of gland; cauda very short and blunt, 0.3–0.4 mm long. Ovary incompletely 2-locular, the ovules axile to free-central, 6 or 7; style early deciduous, unknown. Fruit and seed unknown.

Distribution. Known only from the type locality on the west side of the Andes in the far southwest corner of Colombia.

Mouriri impressinerva is distinguished from all other species in the genus by the combination of its impressed leaf venation, tubular midrib xylem, superficial stomata, tannin-filled leaves, occasional epidermal cells with mucilaginous walls, rectangular to spherical terminal foliar sclereids, medium-length pedicels, small flowers, and small anthers with relatively long thecae and very short caudas. There appear to be no close relatives in any known subgenus or section. The tubular xylem appears to place the species in the subgenus *Mouriri*, perhaps in the heterogeneous section *Litophyllum*, where the lack of stomatal crypts, lack of a hypodermis, and small pedicellate flowers would also agree. However, the leaves with their impressed nerves and terminal sclereids like those of *M. sagotiana*, as well as the tannin-filled leaf tissues, suggest section *Brevipedillus* of subgenus *Taphroxylon*. Tubular midrib xylem is exceptionally found in *M. vernicosa* of *Brevipedillus*. On the other hand, the occasional mucilage walls in the epidermal cells, medium-length pedicels, and anther size and form are out of place in *Brevipedillus*. A tentative assignment of the new species to *Litophyllum* will have to suffice until the seeds are known, which will establish the subgenus for certain.

Mouriri arenicola Morley, sp. nov. TYPE: Brazil. Rio de Janeiro: Sistema de Dunas Dama Branca, baixio umido entre dunas orla, 10 Dec. 1987 (fl buds), *D. Araujo, L. Trindade & A. Gastão 8335* (holotype, GUA; isotype, MIN). Figure 3.

Frutex usque 3 m altus; petioli 1–2 mm long, laminae 3.5–8.1 cm longae, 1.5–3.6 cm latae; pagina inferior costae mediae anguste 2-alata ad angulos; cryptae stomatophorae Type II; sclerides foliorum columnares usque obliquae; calyx ovarium inferum includens 7–11 mm longus, lobi calycis 5, $\frac{9}{10}$ connati usque ad anthesem, tum ad lineas conjunctionis loborum rumpens, lobis tum trapezoideis; ovarium 4-loculare; placentae basilares in quoque loculo, ovula 3 undique circum quamque placentam genita; fructus subglobosus, lobis calycis coronatus, 4-spermus.

Glabrous shrub to 3 m high, sometimes semiclimbing; young twigs narrowly 4-winged. Petioles 1–2 mm long; blades 3.5–8.1 cm long, 1.5–3.6 cm wide, elliptic to ovate-elliptic, abruptly acute or short-acuminate at apex, rounded to broadly acute at base; midrib plane above, narrowly 2-winged below; lateral nerves slightly to moderately visible above and below when dry, the upper surface then with numerous distinct raised points, which mark the ends of the columnar sclereids. Midrib xylem tubular; stomatal crypts Type II (see Morley, 1976), mostly elliptic to inverted-flask shape in vertical section, averaging in a leaf 25–50 μm diam., 22–27 μm high, 71–76 per mm^2; upper epidermis one cell thick, all cells with mucilage walls $\frac{2}{5}$–$\frac{3}{4}$ the cell depth; hypodermis none; free stone cells present only in petiole; terminal sclereids columnar at least in the palisade layer, usually angling below, slender, with 1 or 2 branches at each end. Peduncles 1–2 per side, mostly axillary but sometimes at the upper leafless nodes, each 1–

←
and *7443*). —F. Longisection of flower before anthesis. —G. Anther, cleared to show veins. —H. Fruit (*Araujo 7443*). (B–D, F, G, *Araujo et al. 8335*.)

TABLE 2. *Mouriri arenicola* compared with the two most similar species in its section.

	M. arenicola	*M. arborea*	*M. megasperma*
Young twigs 4-winged	yes	yes–no	no
Free stone cells scattered the length of the midrib	no	no	yes
Petiole length (mm)	1–2	3–10	1.5–3.5
Blade length (cm)	3.5–8.1	7–18.5	7.7–10
Upper leaf surface, dry	numerous distinct raised points	smooth or irregular	smooth
Winged undermidrib	yes	yes	no
Stomatal crypt height	20–27 μm	23–34 μm	45–62 μm
Sclereids	columnar-angling	filiform	columnar-filiform
Peduncle length (mm)	4–20	4.7–1.8	2–6.3
Pedicel length (mm)	2–5	3.5–10.5	ca. 2.6
Ovary + calyx (mm)	7–11	10–17	
Calyx splitting	5 lobes	2–3 pieces	
Calyx retention	persistent	circumscissile	
Ovule number per placenta	3	4–6	
Fruit diam. (mm)	20–30?	20–30?	40–55
Number of seeds	4	4 (?)	5

3-flowered, 3.5–19 mm to base of most distal pedicel measured along the axes and with 1 or 2 internodes in that length; bracts ovate, early deciduous. True pedicels 2–5 mm long; ovary plus calyx in fully developed flower buds 7–11 mm long, ellipsoid to obovoid, the calyx lobes fused for ca. $\frac{3}{10}$ of their length, the free ends triangular, 0.3–0.8 mm long, 0.4–0.7 mm wide, the tip of the corolla protruding 1–1.5 mm between the free tips, the calyx splitting at anthesis into 5 regular trapezoid lobes, these 3.4–5 mm long, 3–3.8 mm wide at base, 1.5–2 mm wide at end; calyx limb 5.5–7 mm long measured from the stamen attachment; free hypanthium 2–2.5 mm long. Mature petals unknown. Mature filaments unknown; anthers 3.4–4.5 mm long; thecae 3.2–3.9 mm long, dehiscing by apical slits; gland 0.4–0.8 mm long, 2.5–3.4 mm from apex of anther when measured from center of gland; cauda 0.7–1.2 mm long. Ovary 4-locular; placentae basal in each locule with 3 ovules borne on all sides of a short basal column; mature style unknown. Immature fruit subglobose, 16–23 mm high, 20–23 mm diam., crowned with the calyx lobes, which surround an apical pit 1.5 mm deep; locules 4, each 1-seeded. Immature seeds with a smooth, hard, polished surface encircling the hilum but not yet extended to the distal part of the seed, the mature seed unknown.

Distribution. Dama Branca dune system, Cabo Frio, ca. 110 km east of Rio de Janeiro; from low to high and shady to sunny situations in the dune vegetation.

Mouriri arenicola falls in subgenus *Mouriri* because of its tubular midrib xylem, placentation in which the ovules encircle each placenta, and seed with a polished surface surrounding the hilum. The appropriate section is *Olisbeoides* because of the long sepals that remain fused till anthesis then split for 3.4 mm or more and are not circumscissile, and because of the large Type II stomatal crypts, which resemble those of *M. arborea* and *M. megasperma*. *Mouriri arenicola* is distinguished from *M. lunatanthera*, the least similar species in the section, by the former's acute to rounded leaf base, winged midrib, columnar sclereids, narrow flower and anthers, and 4-locular ovary. *Mouriri arenicola* is compared to *M. arborea* and *M. megasperma* in Table 2. The new species is distinguished from *M. megasperma* by the 4-winged twigs, smaller leaves, pimpled upper surface and visible nervation of the dry leaf, winged undermidrib, smaller stomatal crypts, longer peduncles, probable smaller fruits, and lesser seed number; and from *M. arborea* by the smaller leaves, distinctly pimpled upper surface of the dry leaf, columnar-angling sclereids, smaller flower, 5-lobed calyx at anthesis with the lobes persistent at least on the immature fruit, and the ovules only 3 per locule.

Mouriri arenicola is most similar to *M. arborea* and appears to be reduced from the forebears of that species in response to the isolated and harsh environment. Many of the characteristics of the new species are ones of size reduction, but the sclereid form and the regular separation and persistence of

the calyx lobes are independent of that trend and suggest a retention of a more primitive state than that developed in *M. arborea*.

The status of *M. sellowiana* (Berg) Burret, a plant yet to be re-collected in the type locality between Vitoria and Bahia, is still uncertain. If synonymous with *M. arborea*, as is probable, the description of its fruit as 21–30 mm high, 25–39 mm in diameter, and 4-seeded would add to the present knowledge of the fruit of that species.

Paratypes. BRAZIL. **Rio de Janeiro:** Mun. de Cabo Frio, Sistema de Dunas Dama Branca, restinga arbustiva fechada, Nome vulgar "Cotia amarela," 9 May 1986 (fr), *D. Araujo 7443* (GUA), 10 Dec. 1987 (fl buds), *D. Araujo et al. 8343* (GUA).

Mouriri grandiflora DC. subsp. **puberula** Morley, subsp. nov. TYPE: Colombia. Municipio de Leticia, Parque Nacional Natural Amacayacu, Centro Administrativo Mata-matá (Inderena), en zona de transición entre "varzea" y tierra alta ("restinga") al norte de la quebrada Mata-matá, 70°15′W, 3°47′S, 110 m, 13 Mar. 1991, *A. Rudas, F. del Aguila Joaquin & Gilberto Morán 1584* (holotype, COL; isotypes, MIN, MO). Figure 4.

Arbor usque 7 m alta; petioli minute puberuli; laminae 16–24 cm longae, supra glabrae, subtus puberulae; costa infra laminam latissima; cryptae stomatophorae 55–65 μm diametris, 22 μm altae, 60–70 in mm²; sclerides terminales foliariae columnares. Fructus cauliflori, lutei, subglobosi, hypanthio et interdum aliquot lobis calycis coronati, ca. 10–17 mm diametris, 1–5-spermi.

Small tree to 7 m high; young twigs terete. Petioles 2.5–3 mm long, minutely puberulent; blades 16–24 cm long, 5.5–8 cm wide, ovate-elliptic to narrowly so, abruptly acuminate at apex, shallowly cordate at base with a notch 0.5–5 mm deep, glabrous above, puberulent below with hairs 0.1–0.2 mm long; midrib plane above, rounded and puberulent below and widest below the lamina; lateral nerves conspicuous above and below when dry. Stomatal crypts averaging in a leaf 55–65 μm diam., 22 μm high, 60–70 per mm² (extremes 20–120 μm diam., 20–25 μm high, 50–85 per mm²); upper epidermis 1–2 cells thick in the same leaf, mucilage walls occasional in the single cells and the inner of the doubled cells; terminal sclereids mostly columnar in whole or in part, sometimes slanting, often branched at one or both ends or up to midway from the ends; hairs usually single, sometimes paired, then 1 long and 1 short, 1-celled but partitioned with numerous cross walls. Fruits cauliflorous, 1–9 per peduncle; peduncles up to 12 mm long to base of true pedicel including up to three internodes in that length; fruiting pedicels 2–2.7 mm long, minutely puberulent; fruits yellow, subglobose, drying subglobose to depressed obovoid, to ca. 17 mm high, 20 mm diam., crowned with the free hypanthium and sometimes one or more calyx lobes, minutely puberulent below and above; fruiting free hypanthium 3.7–4.5 mm long when dry, 4.9–5.4 mm long boiled and presumably when fresh, the outside diameter 5.7 mm dry, 7.1 mm boiled; calyx lobes before anthesis (as seen on young fruits) triangular, minutely puberulent, 2 mm long, 1.6–1.7 mm wide, ca. 5 mm long when measured from the stamen attachment, the calyx splitting apart at anthesis a further distance of 2.2–2.7 mm. Seeds 1–5, brown, polished, 9–10 mm high, 8–9 mm wide, 6–7 mm thick, with one or more irregular incomplete horizontal creases below the middle, the basal hilum as wide as the base of the seed.

Distribution. Tropical forests in far western Amazonia, one locality in the far southeast corner of Colombia near Leticia, the other in mid-eastern Acre near the Amazonas border.

The new taxon falls in or near *Mouriri grandiflora* by virtue of its leaf size and shape, tubular midrib xylem, simple stomatal crypts, epidermal structure, lack of a hypodermis, and the close resemblance of its fruiting calyx, fruits and seeds to those of *M. grandiflora*. From the latter species and all others the new group differs in its puberulent lamina; the larger stomatal crypts and midrib shape also distinguish it, and the thick columnar sclereids are extreme for the species. The only other species in the genus with any pubescence on the leaf is *M. myrtilloides*, in which only the midrib is puberulent, and that species is in a different section and bears little resemblance to *M. grandiflora*. However, puberulence or hints of it occur occasionally in *M. grandiflora* subsp. *grandiflora*. Two collections (*Prance et al. 25775* and *Vasquez et al. 11298*) were noted to have papillae or very short hairs up to 0.07 mm long on the under-midrib only, and several collections have low papillae on the lamina. The papillae are 9–18 μm long with at most a single cross-wall: these plants resemble subspecies *grandiflora* in all other respects: they have no stomatal crypts or small very shallow ones, and their sclereids are usual for the species. The crypts of the new subspecies average 55–65 μm diam., while those of the main subspecies are 25–40 μm. A further difference is apparently found in the rounded undermidrib, which is widest below the lamina, a peculiar feature not noted in subspecies *grandiflora*, although it may have been overlooked.

The overall resemblance between the two taxa

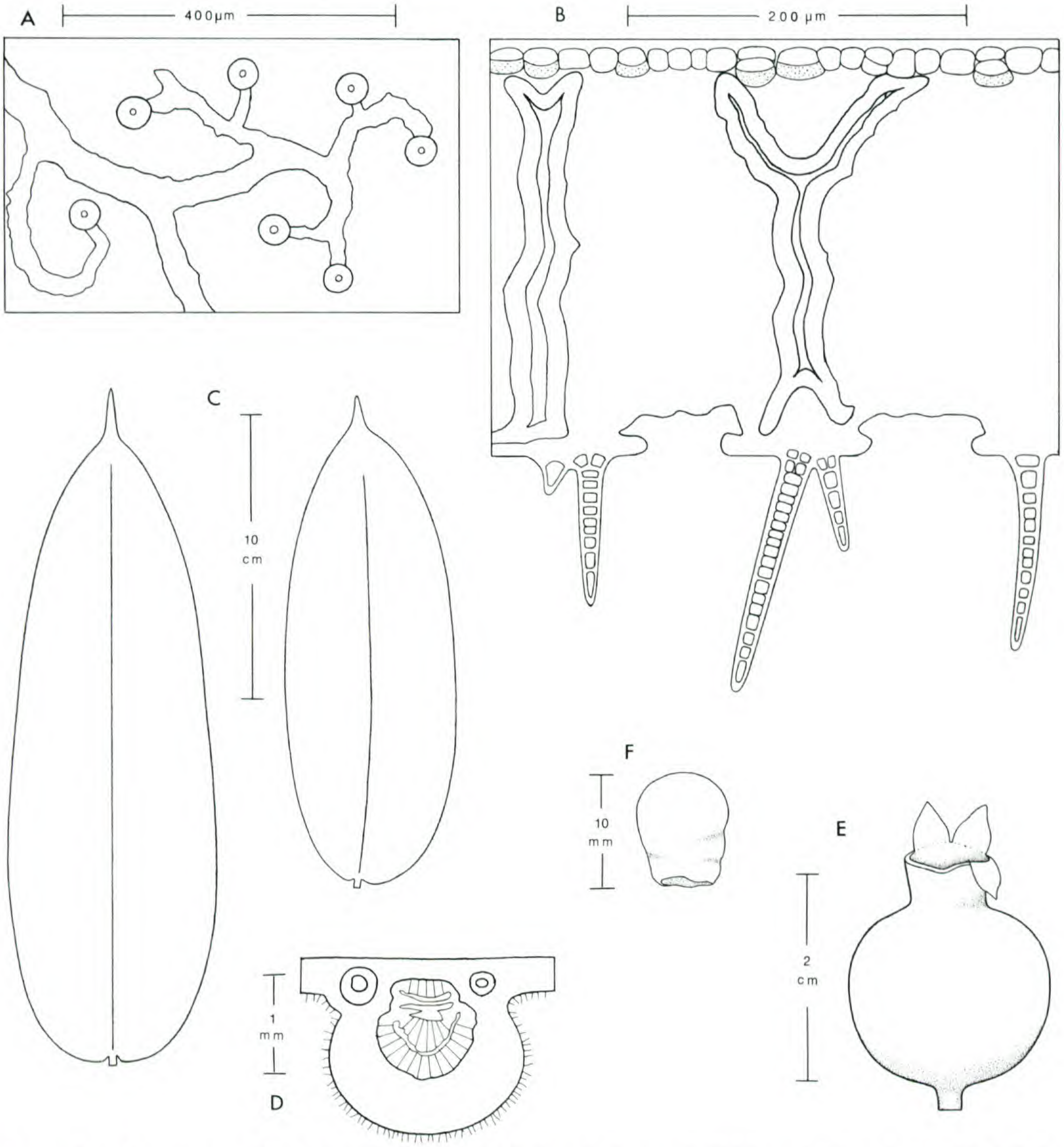


Figure 4. *Mouriri grandiflora* DC. subsp. *puberula* Morley (*Rudas et al. 1584*). —A. Cleared part of leaf blade showing veins and terminal sclereids. —B. Cross section of leaf blade showing sclereids, stomatal crypts, upper epidermis, and hairs. —C. Leaves. —D. Cross section of leaf midrib. —E. Fruit. —F. Seed.

suggests that in prudence they should be considered as part of a single, variable complex. At the same time, in view of the distinct gap between them in pubescence and stomatal crypts and the hard-to-evaluate differences of midrib shape and foliar sclereids, as well as the present lack of information on petals, stamens, and ovary, the possibility remains that in the future it may be necessary to elevate the rank of the new group.

Paratype. BRAZIL. **Acre:** Municipio de Sena Madureira, a 4 km da margem direta do Río Iaco, 5 Oct. 1980, *C. A. Cid & B. W. Nelson 2786* (MIN, NY).

With the recent rediscovery of *Mouriri tess-*

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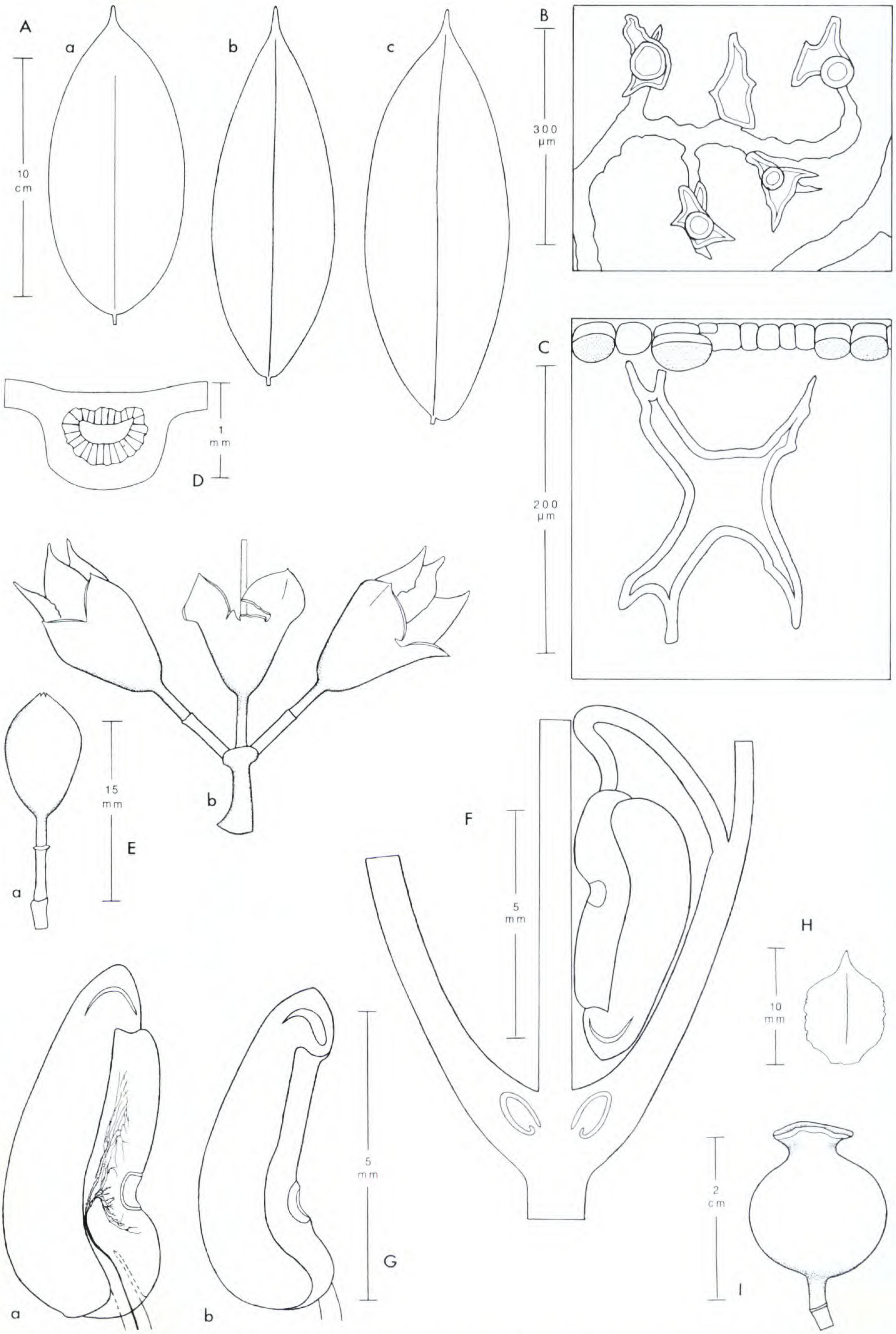
Figure 5. *Mouriri tessmannii* Markgraf. —A. Leaves (a, *Palacios et al. 3365;* b, *Gudiño 127;* c, *Espinoza 57*). —B. Cleared part of leaf blade showing veins and terminal sclereids. —C. Cross section of leaf blade showing sclereids and upper epidermis. —D. Cross section of leaf midrib. —E. Inflorescences: a, flower just before anthesis; b,



inflorescence at anthesis. Some divisions of the calyx are two calyx lobes wide, some only one. —F. Longisection of flower before anthesis. —G. Anthers: a, cleared and expanded in NaOH showing the veins (boiled anthers take the same shape); b, dried. —H. Petal. —I. Immature fruit (*Palacios et al. 3365*). (B–H are *Gudiño 127.*)

mannii after the destruction of the holotype and only specimen at Berlin in World War II, it becomes necessary to designate a neotype.

Mouriri tessmannii Markgraf, Berlin Univ. Bot. Gard. Notizbl. 9: 1147. 1927. NEOTYPE: Ecuador. Napo: Cantón Orellana, Sector Huashito, 20 km al norte de Coca, Propiedad de PALMORIENTE, 00°20′S, 77°05′W, 250 m, 3–21 Nov. 1989, *Edgar Gudiño 127* (neotype, MO; isoneotype, MIN). Figure 5.

The following description is based on the three extant collections; characters of the holotype agree so far as can be determined, except where indicated:

Small trees to 8 m high with trunks to 7 cm diam., the holotype from a tree with a trunk 27 cm diam. and not-very-hard reddish wood, the branches in the latter tree beginning at 5 m above the ground; bark scaly; young twigs rounded; plants glabrous except for the inflorescence. Petioles 2.5–3.5 mm long; blades dark green above and very smooth when fresh, light green below, coriaceous and brittle, 11–19 cm long, 4.2–7 cm wide, elliptic to ovate-elliptic, usually narrowly so, abruptly acuminate at the apex, acute to rounded or abruptly so or nearly truncate at base, sometimes oblique and half-cordate on one side; midrib plane to slightly rounded or very slightly sunken above, prominent and rounded to slightly 2-angled below; lateral nerves slightly visible above and prominent below when dry; surface view of blade at 50× with irregular curving rows of shiny rounded bumps, the rows often crossing at various angles, each bump apparently an epidermal cell. Midrib xylem tubular; stomatal crypts none; upper epidermis lacking all pigments, appearing as a dull white layer in unstained hand-sections at 50×, varying from 1 to 2 cells thick in the same leaf, mostly one cell thick, mucilaginous walls common, mostly in the single cells, less often in the inner of a pair; hypodermis none; terminal sclereids stellate with a strong columnar tendency, the central body 1–4 times as long as wide, often the whole sclereid columnar with sharp arms at each end. Inflorescences on trunk or on leafless branches as little as 5 mm thick, 1–5 per side, each 1–3-flowered, 2–10 mm long to base of farthest pedicel measured along the axes (12–15 mm in the holotype) and with 1 or 2 internodes in that length; bracts 1–1.5 mm long, triangular, acute, early deciduous. Flowers pentamerous; true pedicels 2.5–5 mm long; pedicels and lower part of ovary and calyx minutely puberulent; calyx including inferior ovary yellowish green to yellow, 10–13 mm long, obovoid (14–15 mm long and ellipsoid in the holotype), the lobes nearly completely fused, their free tips 0.3–0.8 mm long, 0.4–0.8 mm wide, the calyx bursting at anthesis usually along some or all of the fusion lines into 3, 4, or 5 ovate-triangular acute lobes of single or double width, sometimes breaking more irregularly, the single lobes 3.3–5 mm long by 3–4.8 mm wide, the double ones 3–4 mm long by 5–7 mm wide; the longest torn edge 4–5(–6) mm; free hypanthium 4–5.7 mm long; calyx limb 4–5.5 mm long as measured from the stamen attachments. Petals purple ("morados") or rose (holotype), separate in the neotype, reported connate in the holotype, elliptic-oblong or elliptic-ovate with the margin irregularly crisped, reported triangular in the holotype, 9.5–10.5 mm long, 6–7 mm wide, acuminate, with a basal claw 0.5–2 mm long by 2.5–4 mm wide. Filaments 10–12 mm long; anthers 5.5–6.4 mm long; thecae 5.5–6.2 mm long, dehiscing by apical slits; gland 0.3–0.6 mm long, 3.5–4.1 mm from apex of anther when measured from center of gland; cauda none; anther shrinking conspicuously in width (theca to gland) on drying so as to change the appearance of the anther and increase the width of the pores. Ovary 5-locular; ovules axile-basal, produced only outwardly from each placenta, 4 per locule; style 19–22 mm long. Fruit subglobose, crowned with the hypanthium and remains of the calyx, 12–ca. 20 mm high excluding hypanthium and calyx, 11–ca. 20 mm diam., 1–5-locular with 1 seed per locule, symmetric when 2–5-seeded, asymmetric when 1-seeded; partly matured seeds with the lower and only mature part polished all over, mature seeds said to be cuneate in the holotype.

Distribution. Primary tropical forests of east Ecuador and northwest Peru; soils red or black; 160–320 m.

Mouriri tessmannii is characterized in its section primarily by its lack of stomatal crypts and lack of pigments in the upper epidermis, by the nearly complete fusion of the calyx lobes in bud, which split apart variously at anthesis, and by the anther form, which changes noticeably on drying.

The identity of the three recent collections as *Mouriri tessmannii* is judged to be reasonably certain, although not an exact fit. The original description is brief; it omits the ovary characters and the anther detail and seldom gives exact measurements, while the photo does not include the petals and stamens, which were in a closed pocket. The three new collections are a good match among themselves. However, four of the discrepancies between these three and the holotype noted in the above description should be remarked on: these are the plant size, calyx and ovary shape, and petal shape and fusion.

The greater size of the holotype is probably not significant, since many species of *Mouriri* exhibit this great a variation, including a close relative, *M. grandiflora*. The ellipsoid shape of the calyx and ovary as opposed to obovoid does not appear insurmountable considering the size differences of the plants and the fact that they come from different parts of the geographic range. Petal shape is notoriously variable in subgenus *Mouriri*, and elliptic-ovate might be called triangular in less exact days. Only the petal fusion appears to be a major discrepancy. Markgraf termed the petals "inter se connata"; in 1927 that might for him have included a light adhesion, and an adhesion could have been caused by a sticky fluid of some sort. In view of the many features in common between *M. tessmannii* and the three collections in question, I conclude that the connate petal statement is a mistake. The petals are separate in all other known American species of the tribe; fusion would be a large departure from the norm and is hardly to be expected.

The three new collections are from an area well north of the type locality, the latter being at the mouth of the Santiago on the Marañon in Peru. *Palacios et al. 3365* comes from east-central Ecuador about 365 km NNE by N from the type locality, and the other two collections are from a site 130 km north of the Palacios one. These are not unusual distributional gaps for species in this region, considering the difficulty of making adequate collections. The limited habitat data is congruent.

Previously (Morley, 1976), it was estimated from the description and photo that *M. tessmannii* belonged in subgenus *Mouriri* sect. *Olisbea*. This placement is substantiated by the neotype and other collections. Specifically, the species falls in the subgenus on the basis of its tubular midrib xylem, axile-basal placentation, polished seeds, common mucilaginous walls in the epidermis, and rose to purple petals. Characters placing these plants in section *Olisbea* are the lack of stomatal crypts in large ovate-elliptic acuminate leaves, pentamerous flowers with long anthers and anther thecae, and calyx lobes nearly fully fused with the petals never protruding before anthesis.

In its section, *Mouriri tessmannii* is unique in its curious epidermis, which lacks all pigments; all the other species have a pigmented epidermis. Beyond this the species appears most similar to *M. rhizophoraefolia* and *M. completens* because of their closed calyces and large leaves lacking stomatal crypts. *Mouriri tessmannii* differs from *M. completens* primarily in having rounded to acute leaf bases, irregular calyx breakage, and different anther and fruit forms. From *M. rhizophoraefolia*, *M. tessmannii* departs in having larger leaves, less strictly columnar foliar sclereids, an acute apex to the closed calyx rather than acuminate, and a different anther form. The third species in the section with a closed calyx, *M. froesii*, diverges further than the preceding two, having stomatal crypts, a midrib that is grooved above and winged below, a different anther shape, and only four locules in the ovary. Although one's attention is drawn to the preceding plants by the common feature of sepal fusion, this feature may have evolved independently from a basal group, thus the true closest relationships may lie with species lacking that character.

Additional specimens examined. ECUADOR. **Napo:** Cantón Orellana, Sector Huashito, 20 km al norte de Coca, Propiedad de PALMORIENTE, 00°20′S, 77°05′W, 250 m (deflor), 3–21 Nov. 1989, *S. Espinoza 57* (MIN, MO). **Pastaza:** Via Auca, 110 km al sur de Coca, a 10 km del Río Tigüino, Sector Cristal, 01°15′S, 76°55′W, 320 m, 7 Jan. 1989 (imm. fr), *W. Palacios, C. Iguago & F. Hurtado 3365* (MIN, MO).

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A New Species of *Parathesis* (Myrsinaceae) from Ecuador

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ABSTRACT. *Parathesis palaciosii* is described and illustrated, and its phylogenetic relationships are discussed.

The genus *Parathesis* J. D. Hooker contains 130 species distributed southward from southern Mexico to Panama, the Caribbean, and through the Andes from Venezuela to Peru. The genus is defined by unique glandular papillae, which are found on the calyx and corolla lobes, and bright yellow anthers. During determination of specimens from the PROMOBOT (Promoción Botánica) project in Ecuador, a new species was encountered, which is here described.

Parathesis palaciosii Pipoly, sp. nov. TYPE: Ecuador. Napo: Cantón Tena, Estación Biológica Jatun Sacha, Río Napo, 8 km E of Misahuallí, 1°04′S, 77°36′W, 400 m, 12–14 Dec. 1989 (fl), *Palacios 4761* (holotype, QCNE; isotypes, F, MO, NY, TEX, US). Figure 1.

Propter laminas chartaceas ad apices acuminatas ad bases acutas decurrentes, secus margines crenulatas, petiolo marginato, sepala ovato-triangulares, petala lineari-lanceolata atro-lineato-punctataque, anthera primo erecta tarde versatilis *P. pyramidalis* valde arcte affinis, sed ab ea laminis ellipticis vel oblongis (non oblanceolatis vel obovatis), nerviis secundariis conspicuis (non inconspicuis) desuper immersis (nec planis), sepalis 1.5–1.8 (non 1–1.2) mm longis, pellucido-(nec atro-)punctatis, squamis lepidotis translucentibus indutis (nec elepidotis), petalis 7–9 (non 5–7) mm longis, staminibus 7–8.1 (non 3–4) mm longis, filamentis 6.4–6.7 (non 2.3–2.5) mm longis, antheris apiculatis (nec obtusis) statim distinguitur.

Tree to 20 m tall, 35 cm DBH; trunk prominently fenestrate, sap copious, clear, odorless; branchlets subterete, 3.5–5 mm diam., finely appressed ferrugineous stellate-tomentose. Leaf blades chartaceous, elliptic to oblong, (8–)14–17(–19) cm long, (3.7–)5–7(–7.5) cm wide, apex abruptly acuminate to caudate, base acute, decurrent on the petiole, midrib raised above and below, secondary veins (19–)20–35 pairs, immersed above, prominently raised below, glabrous above except along midrib, sparsely and minutely ferrugineous stellate-tomentose below, bizonal, the trichomes more densely packed along the midrib area and the veins, densely and prominently punctate, the margin slightly revolute, crenulate; petioles marginate, (1.8–)2.5–3 cm long, glabrous above, densely and minutely ferrugineous stellate-tomentose below. Inflorescence bisexual, terminal, pyramidal, bipinnately paniculate, (6–)12–16 cm long, (6–)10–12 cm wide at base, the principal branches subtended by small leaves, the leaf blades chartaceous, elliptic, 4.5–7.5 cm long, 1.7–3.5 cm wide, apex acuminate, base acute, decurrent on the petiole, otherwise as in vegetative leaves; petioles marginate, 0.7–1 cm long, glabrous above, sparsely and minutely ferrugineous stellate-tomentose below; peduncle obsolete to 1.5 cm long, rachis, branches and pedicels densely appressed ferrugineous stellate-tomentose; floral bracts chartaceous, linear-lanceolate, 2.5–3 mm long, ca. 0.1–0.2 mm wide, apex subulate, early caducous; pedicels cylindrical, erect, 4.8–7.2 mm long, not accrescent in fruit. Flowers corymbose, 5-merous, 7–9.2 mm long, calyx brown, chartaceous, inconspicuously pellucid punctate, densely and minutely tomentose, the sepals ovate-triangular, 1.5–1.8 mm long, 0.9–1.3 mm wide, apex acute, sparsely translucent-lepidote, the margins entire; petals pink, chartaceous, linear-lanceolate, 7–9 mm long, 1.5–1.9 mm wide, apex subulate, densely and prominently black punctate-lineate (the punctations linear), densely and minutely stellate-tomentose without, densely translucent papillose-tomentose along the margin within and throughout the distal ⅓; stamens 7–8.1 mm long, erect, the filaments flat, 6.4–6.7 mm long, prominently black punctate-lineate, the anthers erect, then tardily versatile, lanceolate, 2.2–2.5 mm long, 1–1.2 mm wide, apex apiculate, glabrous, base sagittate, dehiscent by longitudinal slits; ovary globose, densely tomentose with erect hairs, the style filiform, accrescent to 11.7 mm long, the placenta depressed-globose with 4–5 uniseriate immersed ovules. Fruit depressed-globose, 6–8 mm long, 10–12 mm diam. at maturity, black, the exocarp thick, juicy, sweet.

Distribution. Parathesis palaciosii is endemic to the Ecuadorean Amazon in the area of the Jatun Sacha Biological Reserve, 400–450 m elevation.

Ecology. This species occurs in tall very humid forest on rolling hills of lateritic soils. The species is frequently encountered and is a conspicuous element of the subcanopy, according to the collector.

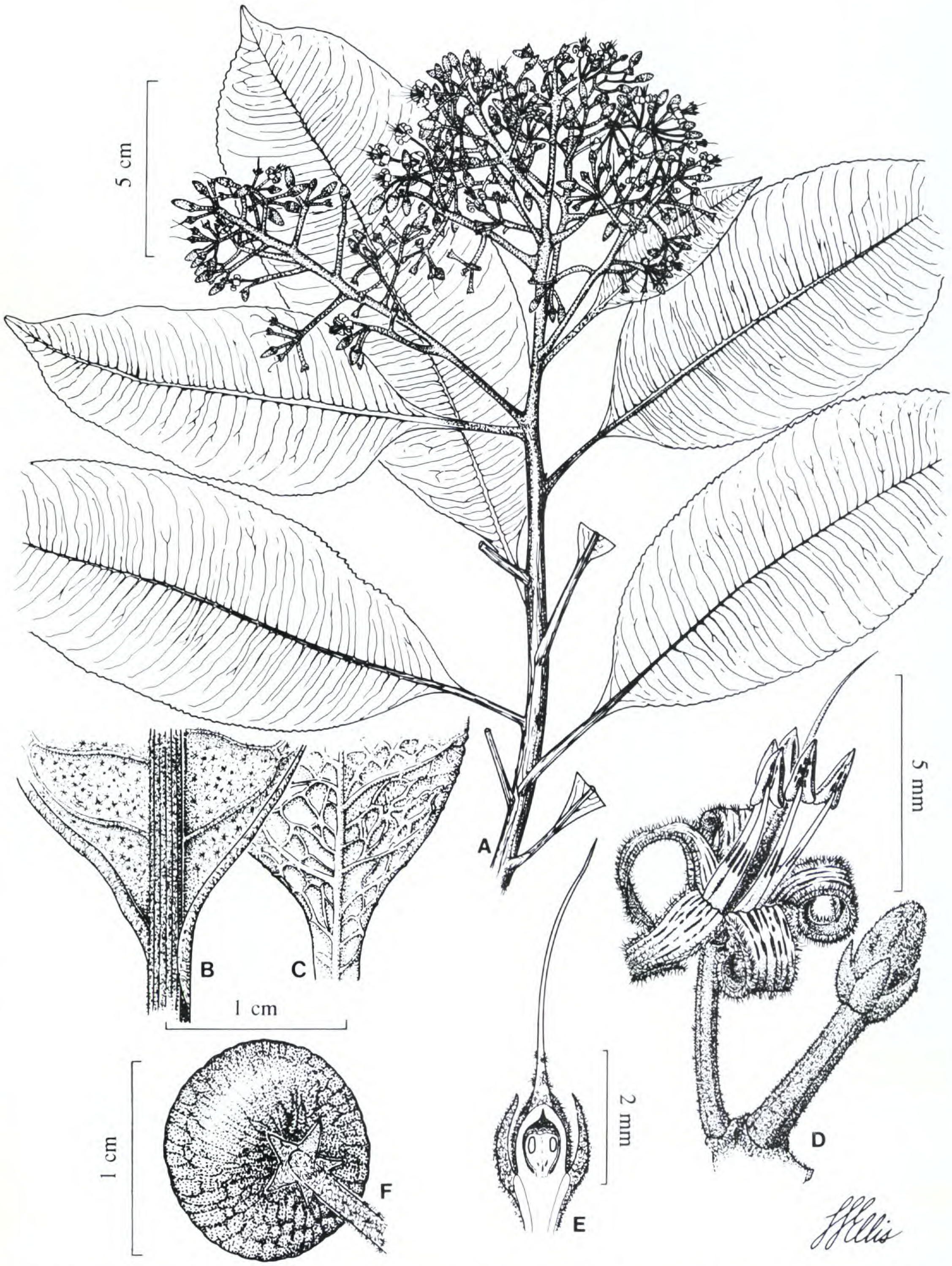

Figure 1. *Parathesis palaciosii* Pipoly. —A. Habit, showing crenulate leaves and reduced leaves subtending inflorescence branch. —B. Abaxial leaf surface, showing slightly revolute margin, tomentum, and marginate petiole. —C. Adaxial leaf surface. —D. Flowers in bud and at anthesis, showing the glandular-papillose, punctate-lineate petals, punctate-lineate filaments, and apiculate anthers with dorsal punctations. —E. Pistil in longitudinal section, showing the depressed-globose placenta with immersed, uniseriate ovules. —F. Fruit, showing acute calyx lobes. A–E drawn from isotype, F drawn from *Palacios 4262*.

Etymology. The species is named for Walter Palacios, specialist in Meliaceae, forestry engineer and parataxonomist for the Missouri Botanical Garden's PROMOBOT program in Ecuador.

Parathesis palaciosii is most closely related to *P. pyramidalis* Lundell, of the Sierra de Santa Marta, Colombia, because of its acuminate, chartaceous, crenulate leaves, ovate-triangular sepals, linear-lanceolate, black punctate-lineate petals, and anthers that are at first erect, then versatile in post anthesis. However, the deeply impressed secondary veins, longer, inconspicuously punctate and translucent lepidote sepals, longer petals and stamens, and apiculate anthers easily distinguish this taxon. The collector reports that the trunks are fenestrate, which is the first report of that trunk morphology for the genus.

Paratypes. ECUADOR. **Napo:** Cantón Tena, Estación Biológica Jatun Sacha, Río Napo, 8 km E of Misahuallí, 1°04′S, 77°36′W, 400 m, 12–14 Dec. 1989 (fr), *Palacios 4262* (AAU, F, GB, MO, NY, QCNE, US), 6 May 1990 (fl), *Palacios et al. 4940* (AAU, F, GB, MO, NY, QCNE, US), 28 Dec. 1987 (ster.), *Gentry et al. 60029* (MO, QCNE).

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Lectotypifications in the Genus *Petrea* (Verbenaceae)

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ABSTRACT. Twenty-one specific epithets in *Petrea* need lectotypification. Of these, 17 holotypes were not originally designated, two types were destroyed during World War II, and two are missing.

As a result of an ongoing study toward a monograph of the genus *Petrea*, a number of specific epithets have been found to need lectotypification. Lectotypifications were not made in Moldenke's (1938) monograph of the genus. During the course of this study, most of the types of *Petrea* were seen via loans or herbarium visits. The objective of this paper is to lectotypify the species for which a holotype was not designated or whose holotype has been destroyed or is missing. In general, the specimens designated here as lectotypes have been selected as the most representative material available among the eligible collections, and are not necessarily the collections deposited at the author's institution (see Phillips et al., 1992, for details).

Petrea algentryi Moldenke, Phytologia 54: 67. 1983. TYPE: Colombia, *Gentry et al. 37075* (lectotype, selected here, MO; isolectotype, MO).

This type was collected along the Río Tagachi, 12 km west of Río Atrato, Chocó, Colombia, on 19 June 1982. According to Moldenke (1983), the holotype was deposited at the University of Texas (TEX), but this type was not found there. In addition, this holotype was never part of Moldenke's herbarium (G. Nesom, pers. comm.). Two specimens of the same collection are at the Missouri Botanical Garden (MO), marked with the word "type." The aforementioned seems to indicate that the holotype is missing. Therefore, one of the sheets at MO is designated as lectotype.

Petrea arborea Kunth, Nov. Gen. Sp. 2: 282–283. 1818. TYPE: Venezuela, *Humboldt & Bonpland s.n.* (lectotype, selected here, P).

This type was collected in Aragua, Venezuela, near the town of Cura, in February 1800. A holotype for this species was not designated. No specimen for this collection exists in the Humboldt–Bonpland or Willdenow herbaria, seen on microfiche. A specimen was found at P and is designated as lectotype.

Petrea aspera Turczaninow, Bull. Soc. Imp. Nat. Mosc. 36: 211. 1863. TYPE: Venezuela, *Funk & Schlim 507* (lectotype, selected here, BR; isolectotypes, BM, G(2), P, W; photo of isolectotype, F, MO, NY(2), TEX, U, W).

This type was collected in Carabobo near San Estevan, Venezuela, at 300 m, in April 1845. A holotype for this species was not designated, and there are numerous extant syntypes. The best specimen of the original collection is designated as lectotype.

Petrea atrocoerulea Moldenke, Feddes Repert. 43: 195. 1938. TYPE: Colombia, *Kalbreyer 1634* (lectotype, selected here, K; fragment of isolectotype, NY; photo of isolectotype, NY, TEX).

This type was collected along the Río Porce, Antioquia, Colombia, on 7 May 1880. Moldenke (1938) designated as the holotype for this species a specimen deposited in B. However, P. Hiepko, the curator of B, informed me that this type was destroyed in World War II. Because of this, the isotype at K is designated as lectotype.

Petrea blanchetiana Schauer in DC., Prod. 11: 617–618. 1847. TYPE: Brazil, *Martius 1029* (lectotype, selected here, BR; isolectotypes, BM, G(2), GH, L, LE, M(2), MO, NY, S; photo of isolectotype, NY).

This type was collected in Bahia, with no collection date given. A holotype for this species was not designated. The species was based on three different collections, *Martius 1029*, *Blanchet 91*, and *Salzmann 433*. Among these, Martius's specimen has more complete label data than the other collections and is duplicated in more herbaria; it agrees with the protologue, and most of the specimens are in good condition. The best specimen of the Martius collection, deposited at BR, is designated as lectotype.

Petrea bracteata Steudel, Flora 26: 764. 1843. TYPE: Suriname, *Hostmann & Kappler 39* (lectotype, selected here, W; isolectotypes, B, BM, C, F, G(2), K, LE, MO, S, U, W(2); fragment of isolectotype, MO, NY; photo of isolectotype, MO, NY, TEX; photo of two isolectotypes overlaid in the same picture, NY).

This type was collected in dense forest, in April 1842; a holotype for the species was not designated. The best of the three original specimens deposited at W is chosen as lectotype. The herbarium of the New York Botanical Garden (NY) has a sheet annotated as a photograph of the type, which looks different from the rest of the collection. However, this photograph was taken from two overlaid sheets of the three original specimens at W.

Petrea brevicalyx Ducke, Bull. Mus. Hist. Nat. Paris, ser. 2, 4: 748–749. 1932. TYPE: Brazil, *Ducke s.n.* (lectotype, selected here, NY; isolectotypes, G, K, RB, S, U, US; photo of isolectotype, GH(2), NY, TEX).

This type was collected in Igarape da Cachoeira Grande, Brazil, on the river shore in Amazonas, near Manaus, with no collection date given. This species was based on two collections, *Ducke s.n.* and *Kuhlmann s.n.*, which are both deposited at RB. The *Ducke s.n.* collection has better specimens and was distributed to more herbaria than *Kuhlmann s.n.* Therefore, the best specimen of the former collection is designated here as the lectotype.

Petrea glandulosa Pittier, Bol. Cient. Tecn. Mus. Com. Venez. 1: 70. 1925. TYPE: Venezuela, *Peraza 11532* (lectotype, selected here, VEN; isolectotypes, NY, US; photo of lectotype, NY, TEX; photo of isolectotype, NY, TEX).

This type was collected at Cerce de Guanare, Portuguesa, Venezuela, in March 1924. A holotype for this species was not designated. The specimen in VEN, which is in good condition, is selected as the lectotype.

Petrea kohautiana C. Presl, Bot. Bemerk. 99. 1844. TYPE: Windward Islands, *Kohaut s.n.* (lectotype, selected here, BR; isolectotypes, B(2), F, G, L, M; fragment of isolectotype, NY).

This type was collected on the Island of Martinique, 1819–1821. According to Stafleu & Cowan (1983), the types were deposited at PR and PRC. Moldenke (1938) stated that the type was in PR, but he did not see it. However, both herbaria indicated that they do not have this holotype in their possession. Because of uncertainty as to whether the putative holotype indicated by Moldenke exists, the sheet at BR, which has the best available material, is designated as lectotype.

Petrea macrostachya Bentham, Ann. Nat. Hist., ser. 1, 2: 448. 1839. TYPE: Guyana, *Schomburgk 158* (lectotype, selected here, K; isolectotypes, BM, BR, F, G, GH, K(2), LE; fragment of isolectotype, NY; photo of isolectotype, F, MO, TEX).

This type was collected along the Currapawaak brook, Guyana, 1835–1839. The type of this species was deposited at K and consists of two sheets of the *Schomburgk 158* collection. However, because the author of the name did not specifically designate one as holotype, a lectotype is designated here.

Petrea martiana Schauer in DC., Prod. 11: 620. 1847. TYPE: Brazil, *Martius s.n.* (lectotype, selected here, M; fragment of lectotype, NY).

This type was collected in woods at San Antonio de Gurupá, Pará, Brazil, 3–16 Sep. 1819. This species was based on two unnumbered Martius collections, collected in the same year and deposited at M. Of these, one was collected in Pará and the other in Amazonas. The specimen from Pará in M is selected as lectotype.

Petrea maynensis Huber, Bol. Mus. Para 4: 602. 1906. TYPE: Peru, *Huber 1489* (lectotype, selected here, MG; isolectotype, RB; fragment of lectotype, F; photo of lectotype, F, NY, TEX; photo of isolectotype, GH).

This type was collected along the Río Ucayalí, between Contamana and Canchahuaya, Loreto, Peru, in November 1898. A holotype for this species was not originally designated. The best specimen of the collection deposited at MG is designated as lectotype.

Petrea mexicana Chamisso, Linnaea 7: 367. 1832. TYPE: Mexico, *Berlandier 136* (lectotype, selected here, G; isolectotype, L; photo of lectotype, TEX).

This type was collected in Tampicos, Tamaulipas, Mexico, in 1829. A type for this species was not designated. Of the two extant duplicates, the best specimen is deposited at G and is here selected as lectotype.

Petrea obtusifolia Bentham, Pl. Hartw. 246. 1846. TYPE: Colombia, *Hartweg 1359* (lec-

totype, selected here, K; isolectotypes, BM, G; fragment of isolectotype, NY; photo of lectotype, NY, TEX).

This type was collected in Tolima, Colombia, in 1843. A holotype for this species was not designated in the protologue. The specimen at K might be the holotype, but this should not be concluded automatically just because Bentham worked at K (Phillips et al., 1992). This specimen, however, is in good condition and is selected here as lectotype.

Petrea ovata M. Martens & Galeotti, Bull. Acad. Roy. Sci. Belgique 11: 329. 1844. TYPE: Mexico, *Galeotti 793* (lectotype, BR; isolectotypes, BR, G(2), GH, LE, U; fragment of isolectotype, NY; photo of lectotype and isolectotype, TEX).

This type was collected in Jalapa, Veracruz, Mexico, in August 1940. A holotype for this species was not designated. Moldenke (1938) assumed that the holotype was at BR and did not designate a lectotype. The specimen at BR that is in good condition is designated as lectotype.

Petrea pubescens Turczaninow, Bull. Soc. Imp. Nat. Mosc. 36: 211–212. 1863. TYPE: Venezuela, *Funck & Schlim 1504* (lectotype, selected here, BM; isolectotypes, BR, G(2), P, U, W; photo of isolectotype, F, MO, NY, TEX).

This type was collected at Mérida near San Cristóbal, Venezuela, at 600 m, in November 1846. A holotype for this species was not designated, and there are many duplicate sheets. The best specimen from the collection has been selected as lectotype.

Petrea racemosa Nees, Flora 4(1): 300. 1821. TYPE: Brazil, *Wied-Neuwied s.n.* (lectotype, BR; isolectotype, G; photo of lectotype, MO, NY, TEX).

This type was collected at Bahia, Rio Grande de Belmonte, Brazil, 23 July–21 Dec. 1816. A holotype for this species was not designated. Moldenke (1938) assumed that the holotype was deposited at BR and did not designate a lectotype. The specimen at BR that is in good condition is designated as lectotype.

Petrea rugosa Kunth, Nov. Gen. Sp. 2: 282. 1818. TYPE: Venezuela, *Humboldt & Bonpland s.n.* (lectotype, selected here, P-HB; isolectotypes, F, P; photo of lectotype, TEX; photo of isolectotype, F, MO, NY(2), TEX).

This type was collected at Distrito Federal, Caracas, Venezuela, without a date. A holotype for this species was not designated. The best specimen is in the Humboldt–Bonpland herbarium at P and is selected as lectotype.

Petrea schomburgkiana Schauer in DC., Prod. 11: 619. 1847. TYPE: Guyana, *Schomburg 108* (photo-lectotype, selected here, MO; duplicate photo, TEX).

The precise locality of the collection is unknown. The holotype was deposited in B, and several photographs exist. However, P. Hiepko (pers. comm.) indicated that the type was destroyed during World War II. In addition, there is no other specimen of the original collection. Fortunately, the photograph available at MO is sufficient to establish the identity of the species and is selected as lectotype.

Petrea subserrata Chamisso, Linnaea 7: 368. 1832. TYPE: Brazil, *Sellow s.n.* (lectotype, selected here, K).

The precise locality of collection and date are unknown. This species was based on several unnumbered collections of Sellow. The best specimen from among these collections is selected as lectotype.

Petrea vincentina Turczaninow, Bull. Soc. Imp. Nat. Mosc. 36: 212. 1863. TYPE: Windward Islands, *Caley s.n.* (lectotype, selected here, G; isolectotype, G; photo of isolectotype, NY).

This type was collected in St. Vincent, Windward Islands, with no date given. A holotype was not designated for this species, and the original collection consists of two sheets both deposited in G. The best specimen of those in G is designated as the lectotype.

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New Species and Combinations in *Ceradenia* (Grammitidaceae)

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ABSTRACT. *Ceradenia asthenophylla*, *C. aulaeifolia*, and *C. tristis* are described from Mesoamerica, and their relationships are discussed. Fifteen species of *Ceradenia* are now known from the region; all are characterized by peculiar whitish glandular paraphyses and lack of hydathodes. Three new combinations are also made in the genus for Andean species: *Ceradenia bishopii*, *Ceradenia intricata*, and *C. semiadnata*.

So that names will be available for the pteridophyte volume of *Flora Mesoamericana*, three new species of *Ceradenia* are herein described. These were recognized as new on specimens annotated by L. E. Bishop, who began a revision of the genus (Bishop, 1988, 1989) but was unable to complete it. In addition to the new species, three new combinations are made for species occurring in South America. These were also contained in an unpublished manuscript by Bishop.

Ceradenia asthenophylla L. E. Bishop ex A. R. Smith, sp. nov. TYPE: Colombia. Huila: Cordillera Central, E slope between Páramo de las Papas and San Antonio, 2,900 m, *Bishop 1984* (holotype, UC). Figure 1I–L.

Ceradeniae knightii affinis, a qua imprimis differt stipitibus sparsim setosis (non dense setosis), laminis 6–10-plo longioribus quam latioribus (non 4–6-plo longioribus quam latioribus), laminis tenuis (non incrassitis) et trichomatibus numerosis ramosis glandulosis praeditis.

Plants epiphytic; rhizome slender, with atropurpureous scales 2–4 × 0.3–0.4 mm, with concolorous setulae or glandular hairs; petiole brown, 2–4 cm × 0.2–0.4 mm, with a few scattered castaneous setae to 3 mm distally and much more numerous simple or branched hairs throughout its length, 0.25–0.35 times the length of the lamina, not flexed distally; rachis abaxially with sclerenchyma exposed, with scattered setae 1.5–3 mm; lamina linear, narrowed at base with 2–4 reduced pinna pairs, apex not seen, deeply pinnatifid, up to 15 cm long; pinnae to 0.8 cm × 4 mm, entire or faintly subrepand, set 70–80° to rachis, at base dilated on both sides or straight acroscopically, apex broadly rounded, with castaneous setae along margins and costae abaxially, a few scattered setae and numerous, branched, glandular hairs on lamina, costal sclerenchyma exposed; texture thin-herbaceous; sori inframedial to medial, up to 4 pairs per pinna, superficial, lacking setae but sporangia intermixed with numerous, stalked, gland-tipped paraphyses.

This species is named for its thin, rather lax leaves (from Greek *asthenes*, weak). It is most closely related to *C. knightii* (Copeland) L. E. Bishop, which has densely setose petioles, lamina only 4–6 times longer than broad, and thick-herbaceous to chartaceous lamina lacking numerous, branched, glandular hairs abaxially. *Ceradenia knightii* is known from Costa Rica, Colombia, and Hispaniola.

Paratype. COSTA RICA. **Cartago:** Cerro de la Muerte, 1 km NW of Villa Mills on Interamerican Hwy., behind Hotel La Georgina, 2,900 m, *Mickel 3206* (NY).

Ceradenia aulaeifolia L. E. Bishop ex A. R. Smith, sp. nov. TYPE: Costa Rica. Limón: Cordillera de Talamanca, SW base of Cerro Kámuk, in shrub-tree páramo, 3,200–3,350 m, *Davidse, Herrera & Warner 25939* (holotype, UC; isotype, MO). Figure 1A–H.

Inter species subgeneris *Filicipectinis* frondibus pendentibus indeterminatibus et laminis perpinnatis ad *C. mayoris* et species affines accedens sed costarum abaxialium sclerenchymate manifeste exposito, frondibus majoribus, pinnis margine valde sinuatis, laminis chartaceis ab eis recedens.

Plants epiphytic or lithophytic; rhizome stout, with castaneous scales 5–10 × 0.3–0.7 mm, with hyaline to concolorous setulae or white glands at the margin; petiole atropurpureous, 10–40 cm × 0.6–1.2 mm, at the base with a few to many castaneous setae to 3 mm usually intermixed with much more numerous short setulae 0.2–0.3 mm, sometimes glabrate distally, about equaling the lamina length, not flexed distally; rachis atropurpureous to blackish, abaxially with scattered hairs and occasionally a few setae, adaxially densely setose; lamina pendulous, lanceolate, usually narrowed at base with 1–4 pairs of reduced pinnae, lacking a distinct apical segment but with prolonged (indeterminate?) apical growth, perpinnate throughout, up to 50 cm (or more?) long;

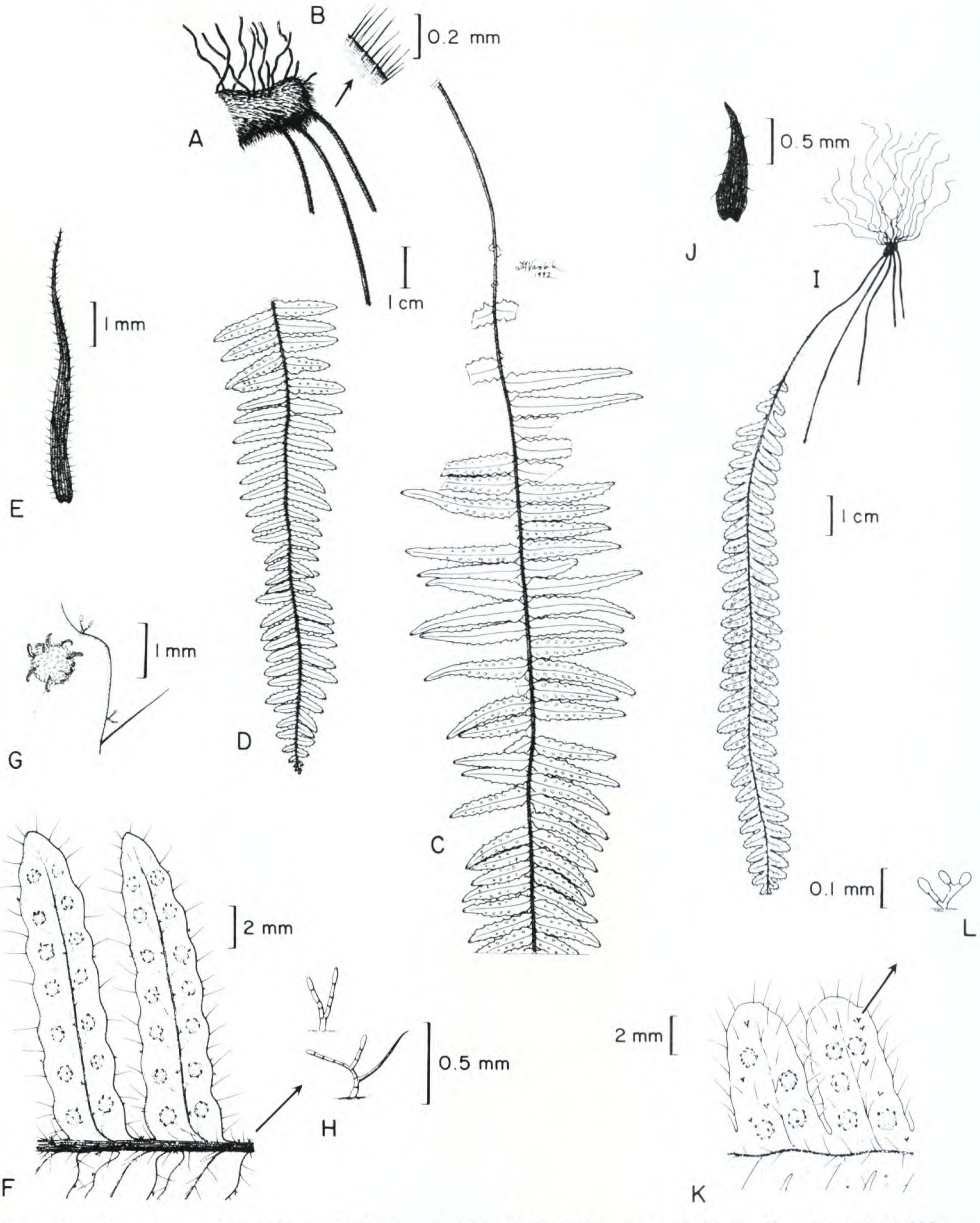

Figure 1. New species of *Ceradenia*. A–H. *C. aulaeifolia* L. E. Bishop ex A. R. Smith, *Davidse 25939* (UC). —A. Rhizome and petiole bases. —B. Setulae at base of petiole. —C. Proximal portion of leaf. —D. Distal portion of leaf. —E. Rhizome scale. —F. Pinnae. —G. Sorus with glands. —H. Trichomes on abaxial rachis. I–K. *C. asthenophylla* L. E. Bishop ex A. R. Smith, *Bishop 1984* (UC). —I. Habit. —J. Rhizome scale. —K. Pinnae. —L. Trichomes on abaxial surface of lamina.

pinnae to 4 cm × 6 mm, strongly sinuate, set 80–90° to rachis, at base usually constricted on both sides, especially acroscopically, apex acuminate to obtuse, with castaneous setae 0.5–1.5 mm and shorter branched hairs along margins, costae with prominently exposed sclerenchyma and simple or branched hairs abaxially, lacking setae, adaxially the costae slightly exposed, with branched hairs and

scattered setae; texture chartaceous; sori medial, up to 12 pairs per pinna, superficial, lacking setae but sporangia intermixed with numerous, stalked, gland-tipped paraphyses.

This striking species is named for the long, pendulous leaves that hang from the trees in high-elevation cloud forests (Latin *aulaeum*, curtain or tapestry). It is closely related to the Colombian *C. mayoris* (Rosenstock) L. E. Bishop, under which Lellinger (1989) treated it, and *C. semiadnata* (Hooker) L. E. Bishop, from Colombia and Ecuador. *Ceradenia aulaeifolia* agrees with these and with *C. intricata* (C. V. Morton) A. R. Smith, *C. congesta* (Copeland) A. R. Smith, and *C. arthrothrix* L. E. Bishop & A. R. Smith in having pendulous fronds, indeterminate leaf apex, and perpinnate laminae with pinnae not connected along the rachis. From all of these it is distinguished by the exposed costal sclerenchyma on both sides of the pinnae, especially abaxially. From *C. mayoris* it also differs in its larger size, more strongly sinuate pinna margins, and thinner laminae. *Ceradenia semiadnata*, which occasionally has the costal sclerenchyma exposed, differs from *C. aulaeifolia* in the presence of setae on the lamina surface and the relatively broader pinnae.

An obvious feature of most specimens of this species is the crowded, short setulae 0.2–0.3 mm on the petioles. This characteristic is shared with *C. mayoris*. In this latter species these setulae are at times lost with age. In *C. aulaeifolia* a few specimens lack them entirely, so that their absence does not appear to be age related.

Paratypes. COSTA RICA. **Cartago:** S slope Volcán de Turrialba, near Finca del V. Turrialba, 2,000–2,400 m, *Standley 35051* (US). **Limón:** Cerro Chirripó, 10,400–11,000 ft., *Evans & Lellinger 168* (US); Cordillera de Talamanca, Cerro Kámuk peak, *Davidse et al. 26048* (MO, UC); Cordillera de Talamanca, SW foot of Cerro Kámuk, 3,200 m, *Davidse et al. 25966* (MO). **San José:** Cerro Chirripó, SW slopes between Canaan and summit, 8,500–10,000 ft., *Evans & Lellinger 81* (US); Cerro de las Vueltas, 2,700–3,000 m, *Standley & Valerio 43743, 43824* (US). PANAMA. **Bocas del Toro:** Cordillera de Talamanca, 4 km NW of Cerro Fábrega peak, 3,000–3,150 m, *Davidse et al. 25414* (MO); between Itamut and Bine peaks, Fábrega massif, 3,200 m, *Gómez et al. 22534* (MO, UC).

Ceradenia tristis A. R. Smith, sp. nov. TYPE: Costa Rica. San José: Pan American Hwy., Km 72–73, or 21–22 km SE of El Empalme, between Cartago and San Isidro del General, 2,800 m, *Smith & Béliz 2077* (holotype, UC; isotype, CR).

Differt a *C. spixiana* paleis rhizomatis castaneis (non aureobrunneis), pinnis basi acroscopica constrictis (non dilatatis utrinque), et apicibus pinnarum attenuatis (non rotundatis vel acutis). Differt a *C. kookenamae* et *C. kalbreyeri* pinnis setosis margine.

Plants epiphytic; rhizome stout, with castaneous scales to 10 × 0.5 mm, these with hyaline or pale setulae; petiole atropurpureous, up to 34 cm × 1.4 mm, with scattered castaneous setae to 3 mm proximally and a few distally, intermixed with simple or branched hairs throughout, ca. 1.5 times lamina length; rachis abaxially with sclerenchyma dark brown, with scattered simple or branched hairs 0.3–0.8 mm, lacking setae or only a few setae toward base; lamina lanceolate, usually broadest just above base (lowermost 1–2 pairs of pinnae slightly reduced), apex not seen, deeply pinnatifid to pinnatisect, at the very base perpinnate, to 22 cm long; pinnae to 5 cm × 5 mm, entire or faintly repand, set 80–90° to rachis, at base usually constricted acroscopically and decurrent basiscopically, apex acuminate, with castaneous setae along margins, scattered simple or branched hairs along abaxial costae; texture thick-chartaceous; sori supramedial, up to 16 pairs per pinna, superficial, lacking setae, sporangia intermixed with numerous, stalked, gland-tipped paraphyses.

The species epithet recalls the sadness felt over Dr. Bishop's tragic illness and death, just as he was entering a most productive period in his research on *Ceradenia* and other genera of Grammitidaceae.

Valerio 68 (US), from Volcán Barba, is close to this species but differs in several characters. The petiolar setae are lacking toward the base, the pinnae are nearly linear-oblong and closely spaced, and the costae lack setae adaxially.

Of Central American ceradenias, *Ceradenia tristis* is most similar to *C. spixiana* (C. Martius ex Mettenius) L. E. Bishop, which differs by the golden brown rhizome scales and more parallel-sided pinnae that are dilate on both sides at their base and more rounded at the apex. Other close relatives in Central America are *C. kookenamae* (Jenman) L. E. Bishop and *C. kalbreyeri* (Baker) L. E. Bishop, which lack setae on the pinna margins. *Ceradenia meridensis* (Klotzsch) L. E. Bishop, from northern South America, differs in having numerous setae along the abaxial costae and in the sori. Colombian specimens annotated by Bishop as *C. killipii* (ined.) are also very similar to *C. tristis* and may prove to be conspecific (*Killip et al. 38061*, US; *Killip & Smith 15910*, NY, US).

Paratype. COSTA RICA. **Heredia:** above Laguna del Barva and summit of Volcán Barva, 10°08′N, 84°06.5′W, 2,840–2,900 m, *Grayum & Quesada 7421* (MO).

Ceradenia bishopii (Stolze) A. R. Smith, comb. nov. Basionym: *Grammitis bishopii* Stolze, Fieldiana, Bot., n.s. 32: 86. 1993. TYPE: Peru. Pasco: Prov. Oxapampa, border Prov. Oxapampa and Pasco, *van der Werff et al. 8569* (holotype, UC).

This was recently described from several collections from Peru (Tryon & Stolze, 1993) and is now known from Bolivia: Cocopunco, 10,000 ft., *Tate 349* (NY).

Ceradenia congesta (Copeland) L. E. Bishop ex A. R. Smith, comb. nov. Basionym: *Ctenopteris congesta* Copeland, Philipp. J. Sci. 84: 397. 1956. *Grammitis congesta* (Copeland) Lellinger, Amer. Fern J. 74: 58. 1984. TYPE: Peru. Loma Grande, La Convención, *Bües 2172* (holotype, US).

Ceradenia congesta is known only from the Peruvian type and is most closely related to *C. intricata* from Colombia and Ecuador.

Ceradenia intricata (C. V. Morton) L. E. Bishop ex A. R. Smith, comb. nov. Basionym: *Grammitis intricata* C. V. Morton, Contr. U.S. Natl. Herb. 38: 101. 1967. TYPE: Ecuador. Pichincha: Guamaní Pass, E of Pifo, *Ewan 16436* (holotype, US).

This was known to Morton (1967) only from the Ecuadorian type, but has since been collected in Colombia. Nariño: Cumbal, vecindad de la Laguna La Bolsa, 3,900 m, *Leist & Möhle 2185* (COL).

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Novae Gesneriaceae Neotropicarum V. Four New Species and Two New Combinations in *Columnea* from South America

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ABSTRACT. A monographic study of sections *Pentadenia* and *Stygnanthe* of *Columnea* (Gesneriaceae) has revealed four species new to science and two new combinations. These species are described here and include *C. atahualpae* and *C. hypocyrtantha* of section *Pentadenia*, and *C. manabiana*, *C. suffruticosa*, *C. ultraviolacea*, and *C. xiphoidea* of section *Stygnanthe*.

Columnea L. is a genus of neotropical plants distributed from southern Mexico to Bolivia comprising approximately 200 species. Species of *Columnea* are readily distinguished by their long tubular corollas that are either bilabiate or ventricose, and the fleshy, indehiscent, berry fruits. The majority of species are epiphytic, although several can be terrestrial as well. A revision of the species of *Columnea* in Ecuador conducted by Kvist & Skog (1993) and a treatment of the Gesneriaceae of Panama by Skog (1979) are the only recent taxonomic treatments of the genus. Wiehler (1973, 1983) divided the genus into four segregate genera and described a fifth genus allied to the *Columnea* complex. These five genera were combined back into the single genus *Columnea* by Kvist & Skog (1993). The four new species described here are the result of a monographic study of two of the smaller sections of *Columnea*, sections *Pentadenia* and *Stygnanthe* (Smith, 1991). The two new combinations result from a recent publication of new species of Gesneriaceae (Wiehler, 1992).

Columnea (section *Pentadenia*) **atahualpae** J. F. Smith & L. Skog, sp. nov. TYPE: Ecuador. El Oro: forest along trail from Sambotambo, following headwaters of Río Moro Moro S to Buenaventura, at and along highway to Portovelo, 29 Aug. 1943, *Steyermark 54228* (holotype, F). Figure 1.

Differt a *Columnea nervosa* (Klotzsch ex Oersted) Hanstein foliis ellipticis vel obovatis bracteis magnis corollis brevis (3.0–3.3 cm longis) marginibus integris trichomatibus appressis aureis.

Suffrutescent terrestrial (or possibly epiphytic) herbs with erect stems to 1 m tall (Fig. 1A). Stems 8–12 mm diam., tawny brown, apex appressed pubescent with golden yellow uniseriate trichomes, lower stem smooth and glabrous. Internodes 2.5–9.0 cm long, leaf scars slightly raised from the slightly swollen nodes. Leaves opposite, equal to subequal, blades obovate to elliptic, 9.2–22.5 × 3.7–7.8 cm, apex acute, base cuneate-oblique, adaxially green, strigose-appressed pilose with single-celled, transparent, and uniseriate golden yellow trichomes, abaxially silvery green-maroon, vestiture similar to adaxial surface but sparser, pubescence of veins abaxially sericeous, margin entire to slightly undulate (Fig. 1A, B). Petioles 1.0–3.2 cm, appressed pilose with uniseriate golden yellow trichomes. Inflorescences 1–7 flowers in axils of either leaf pair (Fig. 1A), floral bracts 1–2 of unequal size, lanceolate-ovate, 8–22 × 1.5–16 mm, apex acuminate, slightly constricted at base, reddish, appressed pilose with uniseriate golden yellow trichomes, margin entire. Pedicels 1.3–1.9 cm, erect in leaf axil, appressed pilose with uniseriate golden yellow trichomes, 1–several glands present on pedicel, purplish, ca. 0.4 mm long. Calyx clasping corolla at base but more open toward apex of lobes, lobes lanceolate-subulate, equal in size, 1.5–2.7 × 0.3–0.5 cm, apex long acuminate, green with red tips to purple, margins serrulate-subulate, 3–5 teeth per side, mostly basal, exterior sericeous with uniseriate golden yellow trichomes, interior surface similar but trichomes sparser (Fig. 1C). Corolla pale yellow, tubular, gibbous at base, slightly ventricose, 3.0–3.3 cm long, 3.0 mm wide at base, 5–8 mm at widest point, 4–5.5 mm before limb, exterior ap-

Figure 1. *Columnea atahualpae* J. F. Smith & L. Skog. —A. Habit. —B. Adaxial leaf pubescence. —C. Pedicel and calyx. —D. Flower. —E. Corolla interior with stamens. —F. Gynoecium with nectaries. —G. Ovary with calyx and nectaries. —H. Berry with nectaries. —I. Seeds. (A, B, D–F from *Steyermark 53840*; C, G–I from *Steyermark 54228*.)

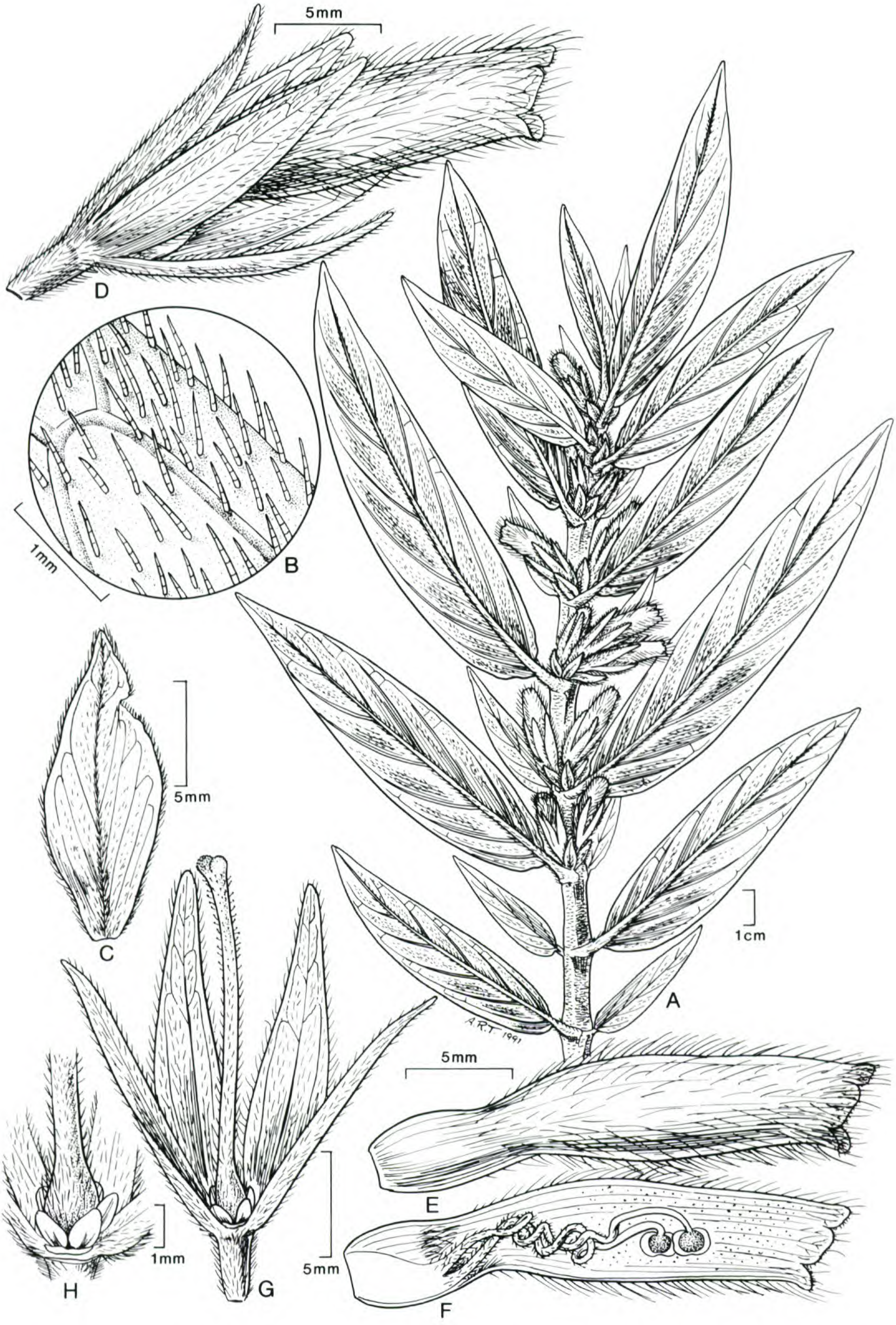

Figure 2. *Columnea manabiana* (Wiehler) J. F. Smith & L. Skog. —A. Habit. —B. Abaxial leaf pubescence. —C. Inflorescence bract. —D. Flower. —E. Corolla exterior. —F. Corolla interior with retracted stamens. —G.

pressed pilose-sericeous with uniseriate golden yellow trichomes (Fig. 1C), interior pilose-hirsute proximally with transparent uniseriate trichomes, glandular capitate trichomes dorsally and distally (Fig. 1E). Lobes equal, 2.0 × 1.5–2.0 mm, semiorbicular-acute. Stamens excluded, filaments white, sparsely pubescent, connate for 5 mm anteriorly at base and adnate to corolla base anteriorly for 3 mm, curling after anthesis, staminodes not seen, included in corolla, anthers quadrate, 1.7 × 1.7 mm (Fig. 1E). Ovary sericeous, 3 mm long, conical, style white, pilose at base, glandular at apex, stigma bilobed, papillose (Fig. 1F). Nectary of 5 glands, dorsal 2 enlarged (Fig. 1G). Berry globose, 1.0 cm diam., color uncertain but probably pale pink, pubescent (Fig. 1H). Seeds fusiform, red-brown, twisted, striate, 1.2–1.3 mm long (Fig. 1I).

Distribution. Known only at 1,035–1,890 m elevation in Ecuador from a small geographic area in El Oro and one other collection in Zamora–Chinchipe. The Zamora–Chinchipe collection is a poor specimen, and its placement within this species is questionable. It may represent another species or may be a specimen of *C. nervosa* (Klotzsch ex Oersted) Hanstein, a morphologically similar species. The placement of this collection in *C. atahualpae* is based on its golden yellow pubescence found throughout the vegetative parts of the plant.

Columnea atahualpae is similar to *C. nervosa.* However, the much larger obovate-elliptic leaves, smaller corolla, large floral bracts, and entire margins are sufficient to distinguish it from this species. In addition, the golden yellow appressed trichomes, found throughout the plant, make it even more distinct from other species of *Columnea.* This species is probably closely related to *C. lophophora* Mansfeld, which also has clustered flowers, large floral bracts, and dense vestiture. This species can easily be distinguished from *C. lophophora* in that the pubescence is tightly appressed and not as dense, or long sericeous as seen in *C. lophophora.*

The specific epithet commemorates one of the last two Sapa Incas to rule the Inca empire in the Andes, Atahualpa, executed by Pizarro in 1533.

Paratypes. ECUADOR. **El Oro:** vicinity of Ayapamba, 13, 16 Oct. 1918, *Rose & Rose 23461* (NY, US); 2 leagues NE of Curtincapa, bordering Quebradas Nudillo and Tambillo, tributary to Río San Luis and Piedra Grande, 13 Aug. 1943, *Steyermark 53840* (F, US). **Zamora–Chinchipe:** Palandra (probably Palanda), July 1876, *André 4638* (NY).

Columnea (section *Stygnanthe*) **manabiana** (Wiehler) J. F. Smith & L. Skog, comb. nov. Basionym: *Pentadenia manabiana* Wiehler, Phytologia 73: 236. 1992. TYPE: Type material from cultivated plants, 8 July 1987, *Wiehler 87102* (holotype, GES not seen; isotypes, B, F, HBG, K, MO, NY, QCA, SEL, U, US, none seen). Type material in cultivation is from live material collected in Ecuador. Manabí: km 67 on road from Chone–Santo Domingo, 500 m, on 31 July 1977, by *C. H. & H. C. Dodson 6791* (AAU, MO, SEL). Figure 2.

Epiphytic herbs (Fig. 2). Stems 6–8 mm diam., squarish when dried, apex pubescent, lower stem smooth and glabrous. Internodes 1.1–2.6 cm long, slightly swollen. Leaves opposite, strongly unequal, blades lanceolate to slightly falcate, larger leaf of a pair 8–16.2 × 1.6–4.5 cm, apex acute, base rounded and strongly oblique, adaxially green but suffused with pink, abaxially pink-purple, slightly pilose with uniseriate red trichomes on both surfaces, margin entire to slightly undulate, lateral veins 5–6 per side. Petioles 2–5 mm, slightly pilose with uniseriate red trichomes (Fig. 2A, B). Smaller leaf 1.6–3.7 × 0.4–1.1 cm, otherwise as larger leaf. Inflorescences of 2–4 flowers per axil of larger leaf (Fig. 2A). Floral bracts 2, conspicuous, ovate, 1.3–1.9 × 0.5–0.9 cm, apex acute, green suffused with red, weakly pilose with uniseriate transparent trichomes, margin entire (Fig. 2C). Pedicels 2.5–4 mm, villous. Calyx loosely clasping corolla, lobes equal to subequal, lanceolate-elliptic, 1.2–1.6 × 2–4.5 mm, apex acute, green or green with red tips, slightly pilose with uniseriate transparent trichomes on both surfaces (Fig. 2D). Corolla yellow, tubular, constricted at base, 1.8–2.4 cm long, 2–2.3 mm wide at base, 3–4.5 mm at widest point, 2.5–3.5 mm before limb, exterior glabrate to villous at apex (Fig. 2E), interior slightly pubescent at base, glandular distally, lobes semiorbicular, inconspicuous, equal-subequal, ca. 1 × 1.5 mm (Fig. 2F). Filaments connate anteriorly for 5 mm, adnate to corolla base anteriorly for 4.5 mm, white, slightly pubescent at base to halfway up filaments, anthers quadrate, 1.3 × 1.3 mm (Fig. 2F). Ovary 2 mm long, pilose, style white, slightly pubescent, glandular at apex, stigma bilobed (Fig. 2G). Nectary of 5 free glands, the dorsal glands enlarged (Fig. 2H). Berry ovoid, 9 × 5 mm, dark in color when dried, probably white, slightly pilose.

←

Gynoecium with calyx and nectaries. —H. Ovary with nectaries and calyx. (A, B from *Dodson et al. 9170;* C–H from *Dodson et al. 6791.*)

Distribution. Known only in Ecuador from Manabí and El Oro, 70–500 m.

This species was long believed to be a morphological variant of *C. spathulata* Mansfeld, but analysis of cpDNA (Smith, 1991) showed it to be markedly different from that species and more closely allied with *C. inconspicua* Kvist & L. Skog. Once the populations that differed from *C. spathulata* were identified based on cpDNA restriction site variation, morphological characters were also detected that distinguish this species, such as large conspicuous floral bracts and falcate leaves.

This species can be distinguished from other species of *Columnea* on the basis of its long, narrow, lanceolate to slightly falcate leaves and small yellow corollas shared with *C. inconspicua* Kvist & L. Skog, to which it is most closely related (Smith, 1991). It is distinguished from *C. inconspicua* by the presence of large, conspicuous, ovate floral bracts that partly obscure the inflorescence.

Additional specimen examined. ECUADOR. **El Oro:** highway from Guayaquil to Machala, 1 km S of Ponce Enriques and 2 km in from road on low hill, 70 m, 9 Oct. 1979, *Dodson et al. 9170* (MO, SEL, US).

Columnea (section *Pentadenia*) **hypocyrtantha** (Wiehler) J. F. Smith & L. Skog, comb. nov. Basionym: *Pentadenia hypocyrtantha* Wiehler, Phytologia 73: 234. 1992. TYPE: Bolivia. Santa Cruz: near Fortaleza between Siberia and Comarapa on the Cochabamba–Santa Cruz road, 2,500 m, 15 Jan. 1965, *Vogel 498* (holotype, US; isotypes, A, F, Z). Figure 3.

Suffrutescent, epiphytic, sublignose herbs with upright ascending stems (Fig. 3A). Stems to more than 50 cm tall, 4–5.5 mm diam., apex sparsely pilose, lower stem smooth and glabrous. Internodes 0.7–32 mm long, nodes slightly swollen, leaf scars raised. Leaves opposite, equal-subequal, blades ovate, 6.3–13.3 × 2.9–8.1 cm, apex acuminate, base rounded, slightly oblique, adaxially dark green, slightly pilose with uniseriate transparent trichomes, abaxially maroon or green suffused with purple, glabrate to sparsely pilose with uniseriate transparent trichomes on the veins, 4–7 lateral veins per side, margin minutely denticulate. Petioles 0.9–2.1 cm long, slightly pilose with uniseriate transparent trichomes (Fig. 3A, B). Inflorescences of axillary, solitary flowers, ebracteate or possibly bracts caducous (Fig. 3A). Pedicels 4–6.4 cm long, red-purple, erect in axil, slightly pilose with uniseriate transparent trichomes, and with oblong, 0.5–0.7-mm dark glands near apex. Calyx clasping corolla, lobes equal, ovate, 12–16 × 4.5–9 mm, apex long acuminate, green with red tips to maroon, both surfaces glabrate with margin entire-ciliate (Fig. 3C). Corolla orange-red, limb and lobes green, tubular, strongly ventricose-saccate with pouch occasionally projecting forward beyond the opening of the corolla, strongly constricted at opening, slightly gibbous at base, 2.4–3.5 cm long, 4–8 mm wide at base, 1.1–1.8 cm at widest point, 3.5–4.5 mm before limb, exterior glabrate-pubescent, trichomes denser toward limb (Fig. 3D), interior glabrous, lobes semiorbicular, equal in size, approximately 1 × 2 mm (Fig. 3E). Filaments glabrous, white, anthers quadrate, 1.5 × 1.5 mm (Fig. 3E). Ovary glabrous, 6 mm long, style glabrous, white, stigma stomatomorphic (Fig. 3E). Nectary of 3–5 free glands, 2 dorsal glands enlarged, slightly connate (Fig. 3E). Berry globose, 9 mm diam., glabrate, green with purple stripes (Fig. 3F).

Distribution. Known only from the type from near Cochabamba, Bolivia, and a few collections nearby at 2,000–2,950 m, growing in cloud forests, and so far only collected in January.

Columnea hypocyrtantha resembles *C. trollii* Mansfeld to which it is probably related on the basis of the strongly ventricose corolla. However, it is easily distinguished from *C. trollii* by its glabrate, ovate leaves, glabrous ovary, and corolla pouch that projects forward beyond the opening of the corolla, a character not seen in any other species of *Columnea.* The species is only known from a few collections within a narrow geographic and temporal range. Therefore, it is difficult to evaluate phenology or distribution accurately.

The name is probably derived from the pouchlike nature of the corolla, which resembles that of the old genus *Hypocyrta* C. F. P. Martius (now a synonym of *Nematanthus* Schrader).

Additionl specimens examined. BOLIVIA. **Cochabamba:** Prov. Chapare, road from Cochabamba to Villa Tunari, 13–16 Jan. 1981, *Luer et al. 564* (SEL), 22 Jan. 1980, *Luer et al. 4877* (SEL); Prov. Carrasco, km 262 on road from Santa Cruz–Cochabamba, 2 km E of Siberia, 18 Jan. 1983, *Besse et al. 1725* (US); Prov. Carrasco, Serrania Siberia, 20–35 km W of Comarapa on old Cochabamba–Santa Cruz road (Hwy. 4), 14–15 Jan. 1990, *Dorr & Barnett 7045* (US).

Columnea (section *Stygnanthe*) **suffruticosa** J. F. Smith & L. Skog, sp. nov. TYPE: Colombia. Choco: Mpio. San José del Palmar, Cerro del Torrá, 7 Jan. 1984, *Silverstone-Sopkin et al. 1594* (holotype, CUVC; isotypes, MO, US). Figure 4.

Columneae ambiguae (Urban) B. Morley affinis sed foliis brevioribus ovatioribus caulibus magis ligneis differt.

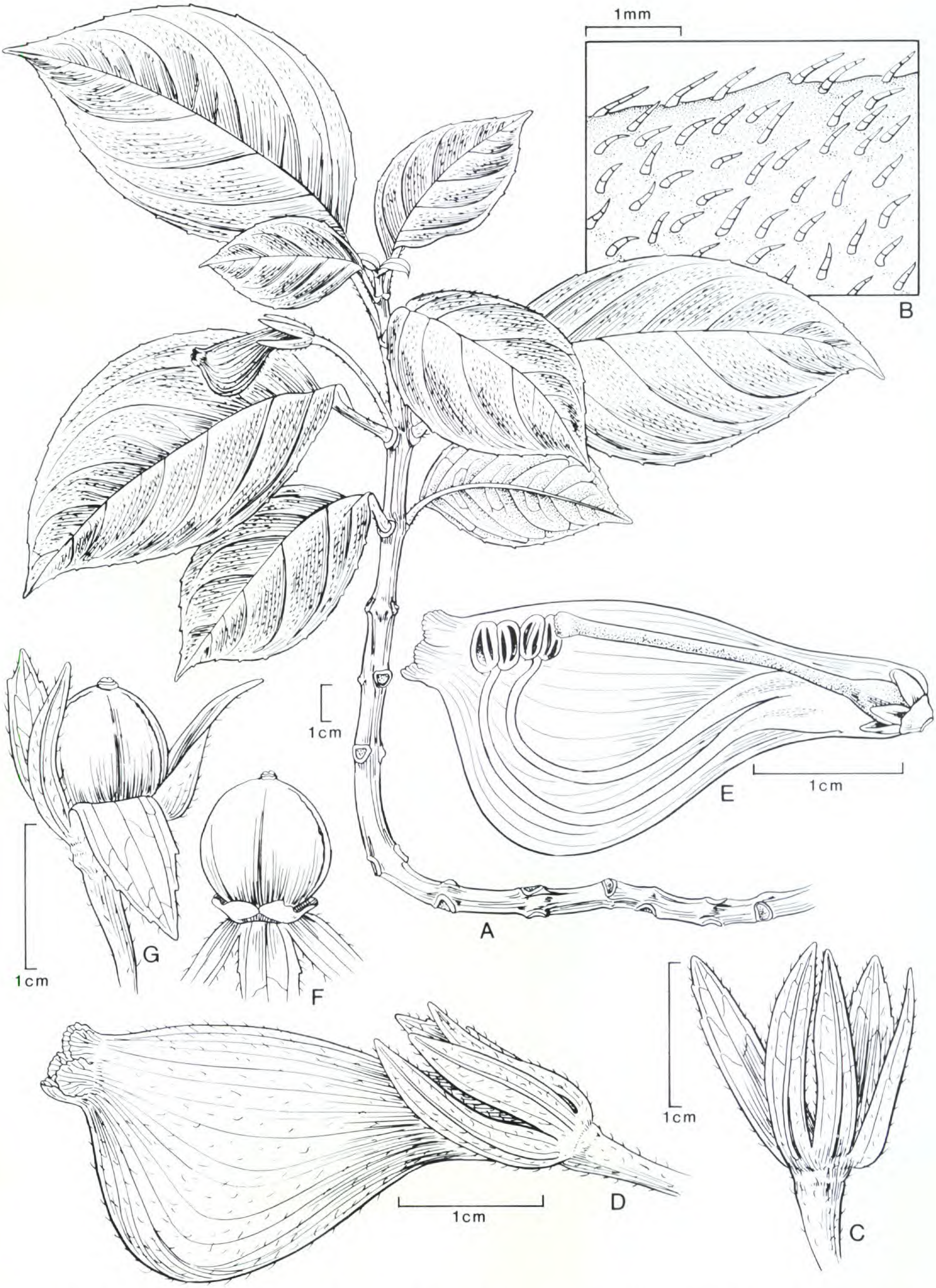

Figure 3. *Columnea hypocyrtantha* (Wiehler) J. F. Smith & L. Skog. —A. Habit. —B. Adaxial leaf pubescence. —C. Pedicel and calyx. —D. Flower. —E. Corolla interior with stamens, gynoecium, and nectaries. —F. Berry with nectaries and calyx lobes pulled away. —G. Berry as seen naturally. (A, B from *Besse et al. 1725;* C–G from *Dorr & Barnett 7045.*)

Figure 4. *Columnea suffruticosa* J. F. Smith & L. Skog. —A. Habit. —B. Adaxial leaf pubescence. —C. Flower. —D. Corolla interior with stamens and gynoecium. —E. Pouchlike protuberences on interior of corolla. —F. Gynoecium with nectaries and calyx. —G. Berry with nectaries. (A from *Silverstone-Sopkin et al. 1594*; B from *Silverstone-Sopkin et al. 4289*; C–G from *Silverstone-Sopkin et al. 4530*.)

Small woody-sublignose shrubs, epiphytic or terrestrial (Fig. 4A). Stems to 2 m, 2–3 mm diam., pubescent or hirsute with uniseriate trichomes at apex, lower stem dark purple, smooth, and glabrous. Internodes 1–3.5 cm long. Leaves opposite, unequal. Larger leaf blades in a pair elliptic-ovate, 1.4–5 × 0.9–2.5 cm, apex acute, base rounded oblique, adaxially dull green, glabrate, abaxially purple mottled to all purple, glabrate, margin crenulate, lateral veins 3–6 per side. Petioles 2–10 mm long, pilose-hirsute (Fig. 4A, B). Smaller leaf blades elliptic-ovate, 0.7–3.9 × 0.4–1.8 cm, otherwise as larger leaf. Inflorescences of 1–2 flowers per axil (Fig. 4A). Floral bracts caducous, linear, up to 3 mm long. Pedicels 5–11 mm, erect, hirsute with purple or transparent uniseriate trichomes. Calyx loosely clasping corolla, lobes equal-subequal, spatulate, 6–11 × 1.5–5 mm, acute, green or purple, margins serrate, exterior surface hirsute to slightly so, interior surface glabrous (Fig. 4C). Corolla yellow with orange spots on lobes, tubular, constricted at base, 1.5–3.1 cm long, 2 mm at base, 4–6 mm at widest point, 3–5 mm before limb, lobes subequal, semiorbicular, 1–2 × 1.5–2 mm, exterior surface slightly sericeous with purple or transparent uniseriate trichomes (Fig. 4C), interior glabrous, glandular distally and dorsally (Fig. 4D). Two pouchlike invaginations occasionally present on dorsal surface of corolla (Fig. 4E). Filaments connate anteriorly for 2.5 mm, adnate to corolla base anteriorly for 1.5 mm, white, glabrous, anthers quadrate, 1.5 × 1.5 mm (Fig. 4D). Ovary 2 mm long, glabrous to sericeous at apex, style white, glabrous with glandular trichomes at apex, stigma stomatomorphic, white (Fig. 4F). Nectary of 5 free glands or with 2 dorsal glands connate (Fig. 4F, G). Mature berry unknown, immature fruit ovoid, 3 × 2 mm, white, glabrous to sparsely pilose (Fig. 4G).

Distribution. Known only from the type locality in Choco, Colombia, and one additional locality nearby on the Choco–Valle del Cauca border at 1,870–2,500 m.

Although it is known from only a few collections, four made within a few days of each other, and the others from the same general locality, this species is distinct from other species of section *Stygnanthe*. The shrubby woody habit of this species readily distinguishes it from other species in this section. In addition, the small, ovate, crenate leaves are distinctive. Phylogenetically, *Columnea suffruticosa* is most likely related to *C. colombiana* (Wiehler) Kvist & L. Skog, as based on a cladistic analysis of morphology (Smith, 1991). However, the corolla lobes with darker colored spots (a character not used in the analysis and previously overlooked in species descriptions) may place it in the clade with *C. ovatifolia* Kvist & L. Skog, *C. lavandulacea* Kvist & L. Skog, and *C. crassicaulis* (Wiehler) Kvist & L. Skog (Smith, 1991). Four of the collections are epiphytic, the others are terrestrial. The subtle morphological differences between the two groups are undoubtedly due to environmental effects of the two habitats. The epiphytic collections have smaller leaves, purple pubescence, and more purple coloration in general. This is likely due to the higher amount of sunlight obtained by the epiphytic individuals than any other factor. Coloration of trichomes, if variable within an individual or species, tends to be present in trichomes more likely to receive sunlight (pers. obs.).

The name is derived from the stems, which are woody at the base.

Paratypes. COLOMBIA. **Choco:** Mpio. San José del Palmar, Cerro del Torrá, up from heliport, 19 Aug. 1988, *Ramos et al. 1357* (CUVC), 5 Aug. 1982, *Silverstone-Sopkin 1225* (CUVC), 4 Jan. 1984, *Silverstone-Sopkin 1496* (CUVC, MO), 6 Jan. 1984, *Silverstone-Sopkin et al. 1563* (MO), 5 Jan. 1984, *Silverstone-Sopkin 1548* (CUVC, MO), 13 Jan. 1984, *Silverstone-Sopkin et al. 1812* (CUVC), 10 Aug. 1988, *Silverstone-Sopkin et al. 4289* (CUVC, US), 17 Aug. 1988, *Silverstone-Sopkin et al. 4530* (CUVC, US), 15 Aug. 1988, *Silverstone-Sopkin et al. 4442* (CUVC). **Valle del Cauca:** Mpio. El Cairo, ca. 21–25 km beyond El Cairo toward Choco border, 13 May 1988, *Luteyn et al. 12288* (CUVC), 25 Apr. 1989, *Luteyn & Giraldo 12644* (CUVC).

Columnea (section *Stygnanthe*) **ultraviolacea** J. F. Smith & L. Skog, sp. nov. TYPE: Bolivia. La Paz: Prov. Sud Yungas, Huancané, 9 km from San Isidro (N of Chulumani), 2,450 m, 1 Jan. 1984, *Beck 8741* (holotype, LPB; isotype, US). Figure 5.

Pentadeniae fritschii (Rusby) Wiehler affinis sed sepalis angustiore violaceis pedicellis violaceis corollis luteis differt.

Semiscandent herbaceous, terrestrial shrubs (Fig. 5). Stems to 1.2 m, 5–6 mm diam., red-brown, apex pubescent, lower stem smooth and glabrous (Fig. 5A). Internodes 1.3–4.5 cm long. Leaves in whorls of 4, equal to subequal, blades elliptic, 2.5–4.5 × 1–2 cm, apex acute, base rounded-cuneate, oblique, adaxially dark green, glabrous, abaxially dark purple, strigillose, appressed hirsute on veins with red uniseriate trichomes, margin entire, ciliate with red uniseriate trichomes, lateral veins 4–5 per side. Petioles 2–6 mm long, purple, pilose-hirsute with red uniseriate trichomes (Fig. 5A, B). Inflorescences of solitary flowers per leaf axil (Fig. 5A). Floral bracts linear, 3–8 mm × up to 0.5 mm, acute, purple,

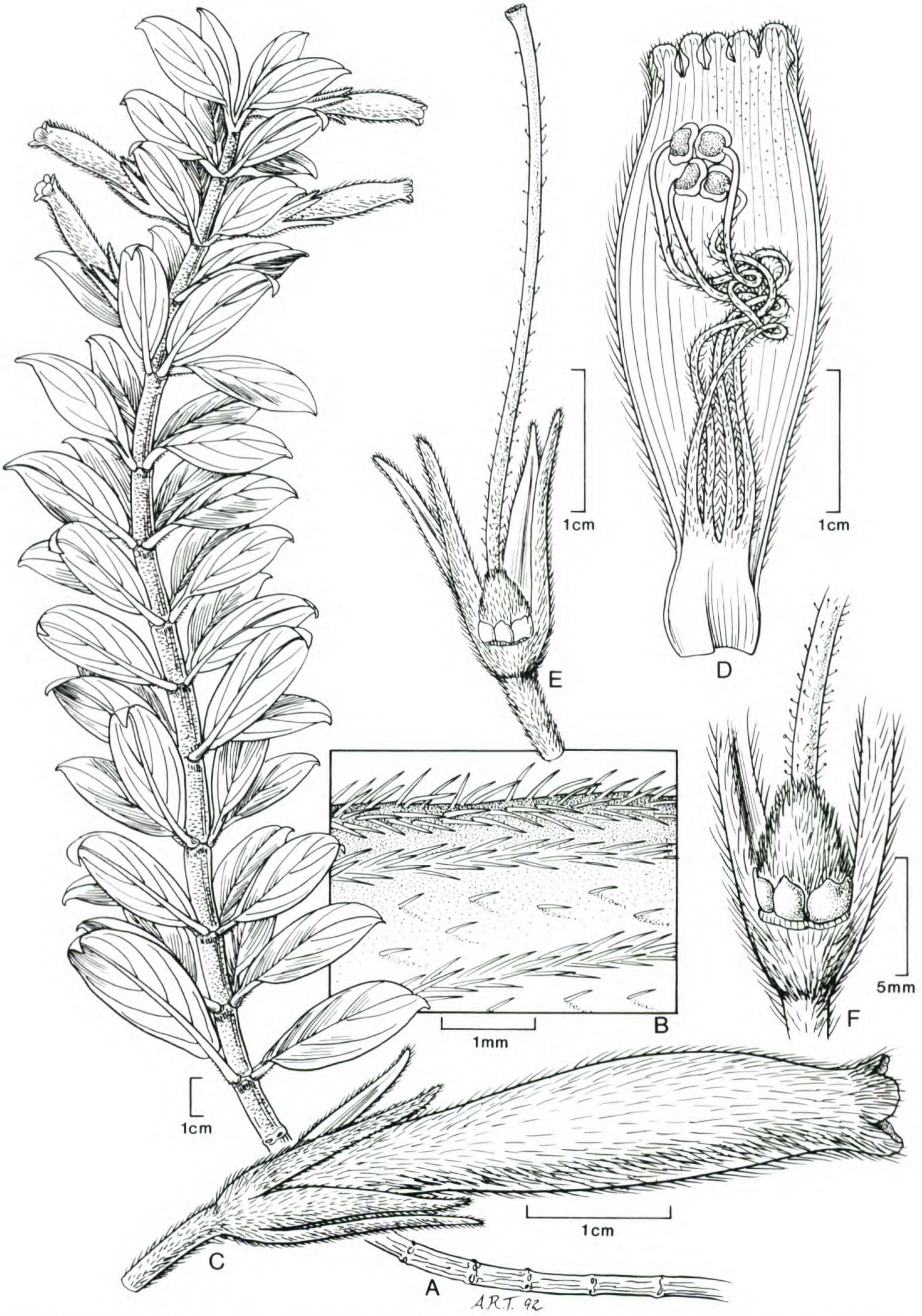

Figure 5. *Columnea ultraviolacea* J. F. Smith & L. Skog. —A. Habit. —B. Abaxial leaf pubescence. —C. Flower. —D. Corolla interior with retracted stamens. —E. Gynoecium with nectaries and calyx. —F. Ovary and nectaries. (All from *Beck 8741.*)

slightly pilose on outer surface, glabrous on interior, margin entire. Pedicels 8–16 mm, purple, erect, pilose-hirsute with red uniseriate trichomes, with darker purple, 0.4–0.7-mm-long oval-elliptic glands near calyx. Calyx loosely clasping corolla, lobes equal-subequal, lanceolate-linear, 13–21 × 1.2–2 mm, acute, purple, margin entire, exterior surface sparsely hirsute with red uniseriate trichomes (Fig. 5C), interior surface glabrous. Corolla light yellow, lobes purple inside, tubular, slightly ventricose, long constriction at base, constricted at limb, 4.1–4.4 cm long, 2–2.5 mm wide at base, 5.5–7 mm at widest point, 3.5–4 mm before limb, lobes equal-subequal, semiorbicular, 2–3 × 2–3 mm, exterior surface densely sericeous with uniseriate transparent trichomes (Fig. 5C), interior slightly pilose at base, glandular distally and dorsally (Fig. 5D). Filaments connate anteriorly for 8 mm, adnate to corolla base anteriorly for 4.5 mm, white, slightly pilose, anthers quadrate, 1.5–2.5 × 1.5–2 mm (Fig. 5D). Ovary 4 mm long, sericeous, red and transparent uniseriate trichomes, style red at base turning yellow, slightly pilose at base, glabrous at apex, stigma stomatomorphic, white (Fig. 5E). Nectary of 5 free glands (Fig. 5F). Berry ovoid, 8–9 × 3–4.5 mm, dark purple with white spot where style was attached, sericeous with red and transparent trichomes.

Distribution. Known only from the type locality in Bolivia at 2,400–2,450 m. Flowering in January, fruiting in May.

Columnea ultraviolacea and *Pentadenia fritschii* (Rusby) Wiehler (soon to be transferred to *Columnea*) are the only two species of *Columnea* to have leaves in whorls of four, easily distinguishing these species from others and thus allying them in a phylogenetic sense. They are distinguished from each other by the yellow corollas, purple coloration of the vegetative parts, and narrow lanceolate-linear sepals of *C. ultraviolacea*. These two are obviously sister species, based on their leaf arrangement, and are closely related to *Columnea moesta* Poeppig, another Bolivian species (Smith, 1991), based on cpDNA variation (Smith, 1991).

The epithet is derived from the bright purple coloration of all vegetative parts and the fruits.

Paratypes. BOLIVIA. **La Paz:** Sud Yungas, 9.2 km toward San Isidro from Huancané, 2 May 1989, *Smith & Smith 1829* (LPB, WIS).

Columnea (section *Stygnanthe*) **xiphoidea** J. F. Smith & L. Skog, sp. nov. TYPE: Peru. Ucayali: Divisoria, 59 km from Tingo María on road to Pucallpa, 17 Nov. 1949–15 Jan. 1950, *Allard 21230* (holotype, BH; isotype, US). Figure 6.

Columneae ovatifoliae Kvist & L. Skog affinis sed foliis longioribus lanceolatis differt.

Herbs with stems to 2 m, 4 mm diam., red-brown, quadrangular when dried, apex slightly to densely sericeous, lower stem smooth (Fig. 6A). Internodes 1.6–4.3 cm long. Leaves equal-subequal, blades lanceolate, slightly falcate, 7–9.1 × 1.4–2 cm, apex acuminate, base rounded, oblique, adaxially green with purple margin, hirsute-pilose with uniseriate red trichomes, abaxially dull rose red, strigose with single-celled trichomes and pilose with red uniseriate trichomes, veins slightly pilose with red uniseriate trichomes, margin entire, lateral veins 6 per side. Petioles 2.5–4 mm, pilose-sericeous with red uniseriate trichomes (Fig. 6A, B). Inflorescences of 1–3 flowers per axil of either leaf (Fig. 6A). Floral bracts 1–2 per inflorescence, linear, 4–11 × 0.5–2 mm, acute, maroon, sericeous, entire (Fig. 6C). Pedicels 7–13 mm long, erect, sericeous with uniseriate transparent trichomes. Calyx clasping corolla, lobes equal, lanceolate, 15–21 × 2–4 mm, apex acute, margin entire, exterior surface green with purple margin and some purple mottling, pilose and strigose, sericeous at base, interior surface bright red-purple, pilose-sericeous (Fig. 6D). Corolla crimson, lobes with dark purple spot inside, tubular, slightly ventricose, constricted at base, 4.2 cm long, 4.5 mm wide at base, 1.1 cm at widest point, 0.8 cm before limb, lobes subequal, semiorbicular, 2 × 3 mm, exterior villous-sericeous, denser toward limb (Fig. 6D), interior hirsute-pilose with glandular trichomes dorsally and distally (Fig. 6E). Filaments connate at base anteriorly for 5 mm, adnate to corolla at base anteriorly for 4 mm, yellow, hirsute, anthers quadrate, 1.7 × 1.7 mm (Fig. 6E). Ovary 3 mm long, sericeous, style yellow, glabrous, stigma bilobed, yellow, papillose (Fig. 6F). Nectary of 4–5 free glands, the 2 dorsal glands slightly connate (Fig. 6G). Fruit not seen.

Distribution. Known only from the type locality in Peru and nearby, at 1,600 m.

The lanceolate, isophyllous leaves and bright red, densely sericeous-lanate corolla of *Columnea xiphoidea* readily distinguish it from any other species of *Columnea*. Although no formal cladistic analysis has been performed on this species, *Columnea xiphoidea* is potentially related to two different clades within section *Stygnanthe*, based on its morphological features. The lanceolate, slightly falcate leaves would tend to ally it with the *C. inconspicua* Kvist & L. Skog–*C. manabiana* clade (Smith, 1991). However, the slightly ventricose, densely sericeous-lanate corolla with dark purple spots on the interior of the lobes would place it with the *Pentadenia*

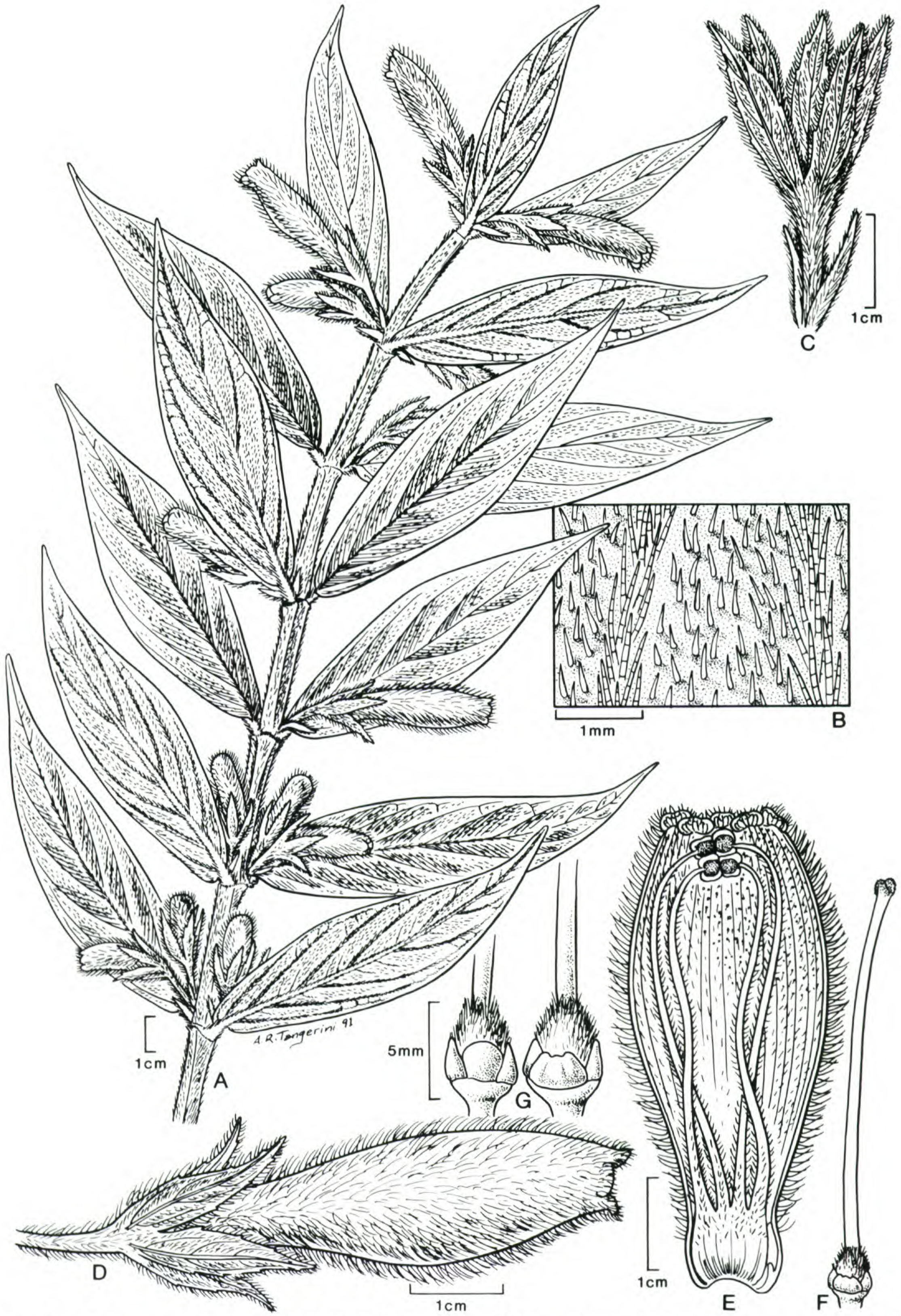

Figure 6. *Columnea xiphoidea* J. F. Smith & L. Skog. —A. Habit. —B. Abaxial leaf pubescence. —C. Pedicel with floral bracts and calyx. —D. Flower. —E. Corolla interior with stamens. —F. Gynoecium with nectaries. —G. Ovary and nectaries. (All from *Allard 21230.*)

fritschii (Rusby) Wiehler–*C. ultraviolacea* clade (Smith, 1991).

The name is based on the long, swordlike leaves of this species, which are unique in section *Stygnanthe*.

Paratypes. PERU. **San Martín:** La Divisoria, "Margarita," 14 Aug. 1946, *Ferreyra 1012* (US); La Divisoria, 59 km from Tingo María on road to Pucallpa, 15 Nov. 1949–15 Jan. 1950, *Allard 21280* (US), *Allard 21300* (US). **Huánuco:** Cordillera Azul, ca. 39.2 km E of Tingo María on road to Pucallpa, 19 Nov. 1979, *Jones & Davidson 9339* (LAM); ca. 43 km E of Tingo María on road to Pucallpa, 21 Nov. 1979, *Jones & Davidson 9432* (LAM).

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New Combinations in the Tribe Poraneae (Convolvulaceae) for the *Flora of China*

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ABSTRACT. New combinations are made for 10 taxa formerly included in the genus *Porana* s.l. in the account of the Convolvulaceae for the *Flora Reipublicae Popularis Sinicae*, which are now considered to belong in the genera *Dinetus*, *Poranopsis*, and *Tridynamia*, as follows: *Dinetus decorus*, *D. dinetoides*, *D. duclouxii*, *D. grandiflorus*, *D. truncatus*, *Poranopsis discifera*, *P. sinensis*, *Tridynamia megalantha*, *T. sinensis* var. *sinensis*, and *T. sinensis* var. *delavayi*. A key to the genera is provided, and 11 additional taxa formerly accepted in *Porana* are reduced to synonymy.

The genus *Porana* N. L. Burman comprises 57 nominate taxa, the majority distributed in mainland tropical Asia. Twenty-eight (14 species, 14 varieties) were recognized in the account of the Convolvulaceae for the *Flora Reipublicae Popularis Sinicae* (Fang & Huang, 1979). My revisionary study of the genus *Porana* and other taxa of the tribe Poraneae H. Hallier (Staples, 1987) indicates that there has been considerable overdescription in the genus *Porana*, and the number of species is actually much lower than the number of named species. Although a comprehensive taxonomic revision of *Porana* s.l. has been submitted to *Systematic Botany Monographs* (Staples, submitted manuscript), several new combinations, and reduction of additional names to synonymy, are needed for the account of the Convolvulaceae for the *Flora of China*, which is scheduled for publication before the revision will appear. This paper makes 10 new combinations needed for use in the *Flora*, and reduces to synonymy 11 other taxa of *Porana* recognized by Fang & Huang (1979).

To summarize the major conclusions of the revision, *Porana* s.l. proved to be a polyphyletic assemblage comprising four distinct groups of species; a preliminary analysis indicated that these four species groups are not a monophyletic lineage inter se (Staples, 1987). I recognize them at generic rank, emending the generic concept of *Porana* to accommodate one group comprising three species, and take up the previously established generic names *Tridynamia* Gagnepain (1950), *Poranopsis* Roberty (1952), and *Dinetus* Sweet (1825) for the other three groups of species. Furthermore, the genus *Cordisepalum* Verdcourt is maintained as a genus distinct from and closely related to *Poranopsis*. These five genera may be distinguished by the following key. Full descriptions of all taxa, distribution data, ecological and phenological summaries, and detailed nomenclatural discussion are presented in the revision (Staples, submitted manuscript) so they are omitted here.

KEY TO GENERA OF ASIATIC PORANEAE

1a. Leaf venation pinnate, or with a single basal pair of secondary veins; calyx about half as long as the corolla, sepals all ± equal in length .. .. *Porana* s.s.
1b. Leaf venation palmate; calyx minute, usually $< 1/10$ as long as the corolla, if larger then sepals markedly unequal.
  2a. Plants entirely herbaceous; flower buds with a minute apical tuft of hairs, otherwise glabrous externally ..... *Dinetus*
  2b. Plants woody (often with herbaceous stem tips); flower buds hairy externally.
    3a. Sepals unequal in flower; fruiting sepals with 3–9 parallel longitudinal veins ..... *Tridynamia*
    3b. Sepals (sub)equal in flower; fruiting sepals with 1 evident midvein.
      4a. Corolla funnelform, white; fruit sessile on torus ..... *Poranopsis*
      4b. Corolla rotate, yellowish; fruit borne on a slender stalk .... *Cordisepalum*

As construed here, *Porana* s.s. and *Cordisepalum* do not occur within the geographic range of the *Flora of China*. Some species of *Poranopsis*, *Dinetus*, and *Tridynamia* occur within the political boundaries of the People's Republic of China, and the following new combinations are proposed for them.

DINETUS SWEET

Dinetus was segregated from *Porana* by Sweet (1825), based on the shape of the corolla, the single filiform style, and 1-celled ovary. He took up *Di-*

netus, an unpublished herbarium name used by Francis Buchanan-Hamilton, at the suggestion of David Don, who had seen the name on Hamilton's specimens in the Lambert herbarium (Sweet, 1825). Sweet included only a single species, *D. racemosus*, when he erected the new genus, but suggested that *P. grandiflora* Wallich and *P. paniculata* Roxburgh would eventually prove to belong to *Dinetus* also. *Porana grandiflora* is herein transferred to *Dinetus* for the first time, while *P. paniculata* is considered a species of *Poranopsis* (q.v.).

As construed here, *Dinetus* includes herbaceous climbers with flower buds glabrous except for a tiny apical tuft of hairs, an entire or apically emarginate, ellipsoidal stigma, and a fruiting calyx reflexed from or tightly wrapped around the fruit, comprised of accrescent sepals with multiple, parallel longitudinal veins. The following new combinations and synonyms are relevant to the *Flora of China*.

Dinetus decorus (W. Smith) Staples, comb. nov. Basionym: *Porana decora* W. Smith, Notes Roy. Bot. Gard. Edinburgh 8: 197. 1914. TYPE: China. Yunnan: [Xinping Yi-Dai Aut. Xian] valley of Ma-li-ouan, Aug. 1913, *Maire 64* (holotype, E; isotype, BM).

Porana mairei Gagnepain *in* Gagnepain & Courchet, Notul. Syst. (Paris) 3: 154. 1915, excluding the note about the fruit, based on *Wilson 4186a*, which is *Dinetus duclouxii*. Syn. nov. TYPE: China. Yunnan: [Xinping Yi-Dai Aut. Xian] rochers dans le val de Mali-ouan, *Maire s.n.* (lectotype, selected here, P; isolectotypes, A, E, G, L, P).

Porana microsepala Handel-Mazzetti, Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Kl. Anz. 58: 229. 1921. Syn. nov. TYPE: China. Yunnan: [Binchuan Xian] Peyentjing, prope Kuti, 27 Aug. 1919, *Ten 1980* (lectotype, selected here, C; isolectotype, WU).

Porana mairei Gagnepain & Courchet var. *holosericea* Wu Cheng-yi *in* Fang Rhui-cheng & Huang Shu-hua, Fl. Reip. Pop. Sin. 64(1): 163. 1979. Syn. nov. TYPE: China. Sichuan: Butuo Xian, Aug. 1959, *Sichuan Liangjang Team 5830* (holotype, KUN; isotype, PE).

Dinetus dinetoides (C. Schneider) Staples, comb. nov. Basionym: *Porana dinetoides* C. Schneider *in* Sargent, Pl. Wilson. 3: 360. 1916. TYPE: China. Yunnan: Mengtsze [Mengzi], alt. 1,700 m, *A. Henry 9340* (holotype, A; isotypes, E, K, MO, NY, US).

Porana megathyrsa Wu Cheng-yi, Yunnan Trop. & Subtrop. Florist. Res. Rep. 1: 101, pl. 18. 1965. Syn. nov. TYPE: China. Yunnan: Shuangjiang Xian, *Sin G. S. 1044* (holotype, KUN; isotypes, IBSC, KUN, PE).

Porana brevisepala Wu Cheng-yi & Huang Shu-hua *in* Fang Rhui-cheng & Huang Shu-hua, Flora Yunnanica 2: 630. pl. 179, f. 4, 5. 1979. Syn. nov. TYPE: China. Yunnan: Kwangnan [Guangnan Xian], Li zhi guo, [Huaguoqing], 8 Nov. 1964, *Wu C. A. 9775* (holotype, KUN; isotype, KUN).

Porana dinetoides C. Schneider *in* Sargent var. *mienningensis* Huang Shu-hua *in* Fang Rhui-cheng & Huang Shu-hua, Fl. Reip. Pop. Sin. 64: addendum 163. 1979. Syn. nov. TYPE: China. Sichuan: Mianning Xian, King-Khoang [Jing Song], *Ying T. S. 4342* (holotype, KUN not seen; isotype, KUN).

Dinetus duclouxii (Gagnepain & Courchet) Staples, comb. nov. Basionym: *Porana duclouxii* Gagnepain & Courchet, Notul. System. (Paris) 3: 153. 1915. TYPE: China. Yunnan: Ky-y, près My-lè [Mile Xian], 5 Sep. 1907, *Ducloux 5459* (lectotype, selected here, P).

Porana triserialis C. Schneider *in* Sargent, Pl. Wilson. 3: 356. 1916. Syn. nov. TYPE: China. Sichuan: Tung River valley, near Wa-shan, Sep. 1908, *A. Henry 3220* (holotype, A; isotypes, A, BM, E, F, K, MO, US).

Porana triserialis var. *lasia* C. Schneider *in* Sargent, Pl. Wilson. 3: 362. 1916. Syn. nov. *Porana duclouxii* Gagnepain & Courchet var. *lasia* (C. Schneider) Handel-Mazzetti, Symb. Sin. 7: 809. 1936. TYPE: China. Yunnan: "probably at Mengtsze" [Mengzi], *A. Henry 9229c pro parte* (holotype, A).

Porana lutingensis Lingelsheim *in* Limpricht, Repert. Spec. Nov. Regni Veg. 12: 471. 1922. Syn. nov. TYPE: China. Sichuan: "Lu ting tschiau [Luding Xian], Talhänge des Tung ho an der Strasse nach Wa sse kou, Ta tsien lu," *A. Limpricht 1628* (holotype, not seen; photo and fragment at A ex WRSL).

Porana lobata Wu Cheng-yi, Yunnan Trop. & Subtrop. Floris. Res. Rep. 1: 105. pl. 34, f. 3. 1965. Syn. nov. TYPE: China. Sichuan: Kwang-yun Hsien [Guangyuan Xian], 28 Sep. 1930, *Wang F. T. 22608* (holotype, KUN; isotypes, NAS, PE).

Dinetus grandiflorus (Wallich) Staples, comb. nov. Basionym: *Porana grandiflora* Wallich *in* Roxburgh, Fl. Ind. ed. Carey, 2: 41. 1824. *Dinetopsis grandiflora* (Wallich) Roberty, Candollea 14: 27. 1952. TYPE: Nepal. Sheoparie [Sheopore], *Wallich*, July 1821 (lectotype, selected here, K-W 1324.1.A, excluding packet contents; isolectotype, CAL-Wallich 1324.bis, sheet 314331).

Porana stenoloba Kurz, J. Bot. 11: 136. 1873. TYPE: [India. West Bengal:] Sikkim-Himalaya, not infrequent along the post-road from Kersiong to Darjeeling, *S. Kurz*, 25 Oct. 1868 (holotype, CAL; isotypes, K).

Ipomoea cuspidata D. Don, Prodr. Fl. Nepal. 98. 1825. TYPE: Nepal. Sine loco, *Hamilton s.n.* (type not found); synonymized by Hallier (1911).

Dinetus racemosus (Roxburgh) Buchanan-Hamilton ex Sweet, Brit. Fl. Gard. 2: pl. 127. [1

Oct.] 1825. *Porana racemosa* Roxburgh ex Wallich *in* Roxburgh, Fl. Ind. 2: 41. [Mar.–June] 1824. TYPE: Sine loco, *Herb. Roxburgh s.n.* (lectotype, selected here, K-W 1326E, 1 excluding fruiting specimen at lower left, 1326E, 2).

Porana cordifolia Ledebour, Ind. Semin. Horti Acad. Dorpat., suppl. 2: 6. [6 Dec.] 1824. TYPE: Estonia. [Tartu:] cult. in hort. bot. Dorpat, *Herb. Ledebour s.n.* (lectotype, selected here, LE; isolectotypes, LE, W).

Porana racemosa J. Jacquin *in* Sprengel, Syst. Veg. ed. 16, 1: 614. 1825 [late 1824]; Ecl. Pl. Rar. 2: 11, pl. 165. 1844, non Roxburgh ex Wallich *in* Roxburgh (1824). TYPE: Nepal. Sine loco, *Wallich distr. 1326* (lectotype, selected here, W; isolectotypes, LE, S, W).

Porana dichotoma Buchanan-Hamilton ex D. Don, Prodr. Fl. Nepal. 99. [1 Jan.–1 Feb.] 1825 cited as synonym, invalid under Article 34.

Porana elegans Zollinger & Moritzi, Natuur-Geneesk. Arch. Ned.-Indië 2: 571. 1846 [1845]. TYPE: [Indonesia.] Java: in montosis Tengger, pr. Poespo, Oct. 1844, *Zollinger distr. 2560* (lectotype, selected here, A; isolectotypes, BM, G, LE, P).

Porana gagnepainiana Lévéille, Cat. Pl. Yun-Nan 58. 1916. TYPE: China. Yunnan: haies de la plaine à Long-Ky, *E. Maire*, June 1912 (holotype, E; isotypes, A, G, W).

Porana racemosa var. *tomentella* Wu Cheng-yi, Yunnan Trop. & Subtrop. Floristics Res. Rep. 1: 103. pl. 33, fig. 4. 1965. Syn. nov. TYPE: China. Yunnan: Jennyeh Hsien, Hwei-du, Oct.–Nov. 1936, *Wang C. W. 80276* (holotype, KUN; isotype, A).

Porana racemosa var. *violacea* Wu Cheng-yi, Yunnan Trop. & Subtrop. Floristics Res. Rep. 1: 103. pl. 34, fig. 1. 1965. Syn. nov. TYPE: China. Sichuan: Muli Xian, 7 Sep. 1937, *Yü T. T. 14179* (holotype, KUN; isotypes, A, KUN).

Dinetus truncatus (Kurz) Staples, comb. nov. Basionym: *Porana truncata* Kurz, J. Bot. 11: 136. 1873, *non P. truncata* (Göppert) Schimper (1890), a fossil species. TYPE: Myanmar. [Pegu Division:] Karenee hills near Toungoo, Dec. 1858, *F. Mason 17* (lectotype, selected here, K; isolectotype, HBG).

Porana racemosa var. *sericocarpa* Wu Cheng-yi, Yunnan Trop. & Subtrop. Florist. Res. Rep. 1: 103, pl. 33, fig. 3. 1965. Syn. nov. TYPE: China. Yunnan: Jingdong Xian, Wuliangshan, 27 Oct. 1950, *Chiu P. Y. 53220* (holotype, KUN; isotypes, KUN, PE).

Poranopsis Roberty

Roberty (1952) segregated the genus *Poranopsis* from *Porana* s.l. and included two species in it, one with large flowers, *P. spectabilis* (including *Porana megalantha* as a synonym), and one with small flowers, *P. paniculata*. Later, Roberty (1964) typified the genus on *Poranopsis paniculata*. I have restricted Roberty's generic concept to include only small-flowered taxa with an accrescent fruiting calyx in which the three outer sepals are dramatically enlarged and each sepal has a single prominent midvein, which gives rise to a reticulum of much finer secondary veins. This emended generic concept includes three species, two of which occur naturally in China and require new combinations. The third species, *Poranopsis paniculata* (Roxburgh) Roberty, ranges widely across the Indian subcontinent from Pakistan to Myanmar and is rather common throughout, but has been collected only once from China, on the Chinese side of the border area between Xizang Autonomous Province [Tibet] and Arunachal Pradesh state, northeastern India.

Poranopsis discifera (C. Schneider) Staples, comb. nov. Basionym: *Porana discifera* C. Schneider *in* Sargent, Pl. Wilson. 3(2): 358. 1916. *Cardiochlamys discifera* (C. Schneider) Wu Cheng-yi, Yunnan Trop. & Subtrop. Florist. Res. Rep. 1: 106, pl. 34, fig. 4. 1965. TYPE: China. Yunnan: Szemao [Simao prefect., Pu'er Xian], forests to south, *A. Henry 12694* (holotype, A; isotypes, A, K, MO, NY, fragment W).

Poranopsis sinensis (Handel-Mazzetti) Staples, comb. nov. Basionym: *Cardiochlamys sinensis* Handel-Mazzetti, Akad. Wiss. Wien Sitzungsber. Math.-Naturwiss. Kl. Abt. 1, 57: 241. 1920. *Porana henryi* Verdcourt, Kew Bull. 26: 137. 1971, nomen novum, non *P. sinensis* Hemsley (1890). TYPE: China. Yunnan: in faucibus fluminis Djinscha-djiang [Jinsha Jiang] ad septentr. urbis Yünnanfu [Kunming], 19 Mar. 1914, *Handel-Mazzetti 751* (holotype, W; isotype, WU).

Tridynamia Gagnepain

Gagnepain (1950) erected the genus *Tridynamia* for a single species, *T. eberhardtii*, from Indochina that had three much enlarged, winglike fruiting sepals. Ooststroom (1963) recognized that *T. eberhardtii* was referable to *Porana*, but he could not decide whether the species already had a name in that genus; he stated that *T. eberhardtii* was very closely related to *Porana spectabilis* Kurz, and might be conspecific with it.

I have resurrected Gagnepain's generic name for a group of four species and two varieties segregated from *Porana* s.l. *Tridynamia* may briefly be characterized as having the outer two or three sepals greatly enlarged in fruit, with 3–9 parallel longitudinal veins in the sepals, and no evident midvein. A calycle of two or three sepaloid bracts is often

present below the true calyx. The genus is distributed from northeastern India across Myanmar, southern China, including Hainan Island, Thailand, Indochina, and south as far as peninsular Malaysia and the Andaman Islands. Two species, one comprising two varieties, occur in China, necessitating the following new combinations.

Tridynamia megalantha (Merrill) Staples, comb. nov. Basionym: *Porana megalantha* Merrill, Lingnan Sci. J. 14: 53. fig. 18. 1935. *Porana spectabilis* Kurz var. *megalantha* (Merrill) How *in* Chun W. Y., Fl. Hainanica 3: 475. fig. 867. 1974. TYPE: China. Hainan Island, Ngai distr., Ch'iu Sam Ts'uen, 7–25 Aug. 1932, *Lau S. K. 373* (holotype, NY; isotypes, A, B, BM, E, G, K, MICH, MO, P, PE, UC, US, W).

Many authors (e.g., Gagnepain & Courchet, 1915; Fang & Huang, 1979) have long misinterpreted *Porana megalantha* and *P. spectabilis*. The two are distinct species, the former distributed throughout the range of the genus, the latter narrowly endemic in western Thailand and adjacent eastern Myanmar. No authentic material of *P. spectabilis* has been seen from China, and all specimens called that are actually *P. megalantha*.

Tridynamia sinensis (Hemsley) Staples var. **sinensis,** comb. nov. Basionym: *Porana sinensis* Hemsley, Index Fl. Sinensis 2: [J. Linn. Soc. Bot. 26] 167. 1890. TYPE: China. Kwangtung: [Guangdong, Lienchan River], 27 Aug. 1887, *C. Ford 290* (holotype, K; isotypes, IBSC, P).

Porana esquirolii A. Léveillé, Repert. Spec. Nov. Regni Veg. 9: 444. 1911. TYPE: China. Kouy-Tcheou [Guizhou:] sine loco [Petrus Hiá], *J. Esquirol 976* (holotype, E, photo A; isotypes, A, K).

Vatica cordata Hu H. H., J. Arnold Arbor. 11: 225. 1930. TYPE: China. Kwangsi [Guangxi:] Bako Shan, W of Poseh Hsien [Bose Xian], 14 Sep. 1928, *Ching R.C. 7426* (holotype, PE; isotypes, fragment A, IBSC, W).

Tridynamia sinensis var. **delavayi** (Gagnepain & Courchet) Staples, comb. nov. Basionym: *Porana delavayi* Gagnepain & Courchet, Notul. Syst. (Paris) 3: 153. July 1915. *Porana sinensis* Hemsley var. *delavayi* (Gagnepain & Courchet) Rehder, J. Arnold Arbor. 15: 319. 1934. TYPE: China. Yunnan: rochers de Ki-Mi-Se, près Kiang-yu [Jiangyun], [30 May 1888], *Delavay 3539* (lectotype, P; isolectotype, A; in effect designated by Huang Shu-hua *in* Fl. Yunnanica 2: 626. 1979).

Porana confertifolia Wu Cheng-yi, Yunnan Trop. & Subtrop. Florist. Res. Rep. 1: 104. pl. 34, fig. 2. 1965. Syn. nov. TYPE: China. Sichuan: Tsing-chuan-fin Hsien [Jinchuan Xian], 21 Aug. 1930, *Wang F. T. 22308* (holotype, KUN).

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New Combinations in *Schoenoplectus* (Cyperaceae)

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ABSTRACT. Results from a recent taxonomic treatment of species of *Scirpus* sensu lato occurring in Virginia indicate that they are a heterogeneous group. Three segregate genera are recognized as occurring in Virginia: *Scirpus* sensu stricto, *Trichophorum*, and *Schoenoplectus*. The transfer of four species to *Schoenoplectus* is made. These combinations are made prior to a treatment of Virginia *Scirpus* sensu lato forthcoming in the journal *Bartonia*.

A taxonomic study of *Scirpus* sensu lato (Strong, 1991) was recently completed for Virginia and is forthcoming in the journal *Bartonia* (Strong, in press). As a result of this study, four new combinations are needed in *Schoenoplectus*. This note states the taxonomic rationale and validates these new combinations so that they are available to other workers.

When *Scirpus* was described (Linnaeus, 1753), it was heterogeneous. Since then, many of the original species have been referred to other genera in Cyperaceae, e.g., *Eleocharis*, *Fimbristylis*, *Bulbostylis*, *Cyperus*, and *Scleria*. The remaining species, and others described since Linnaeus, were treated by many workers as homogeneous. This particularly applies to those species having imbricate floral bracts, hypogynous bristles, and achenes with an undifferentiated style base.

Embryological, anatomical, morphological, and cladistical evidence accumulated during the past 30 years indicates that many of the species still referred to *Scirpus* are heterogeneous (van der Veken, 1965; Schuyler, 1971a, b, 1972; Goetghebeur, 1986) and are better placed in segregate genera, with *Scirpus sylvaticus* L. designated as the type for *Scirpus* sensu stricto (Wilson, 1989).

The conclusions of my studies, based on morphological analysis as well as a review of embryological, anatomical, and cladistical studies, confirm that *Scirpus* sensu lato is a heterogeneous group. Species occurring in Virginia comprise three segregate genera: *Trichophorum*, *Scirpus* sensu stricto, and *Schoenoplectus*.

Goetghebeur & Simpson (1991), citing embryological and morphological evidence, argued that species of *Scirpus* sensu lato that are applied to the genus *Bolboschoenus* are significantly distinct from *Schoenoplectus* to warrant maintaining them in a separate genus. They argued that the one character that they recognize *Schoenoplectus* and *Bolboschoenus* as having in common (embryo morphology) cannot justify placing them together. My studies conclude that there are not only similarities between embryo shape, but between leaf anatomy, floral morphology, and inflorescence. The morphological characters that are usually emphasized as distinguishing *Bolboschoenus* and *Schoenoplectus* (well-developed cauline leaves and terminal inflorescence subtended by several involucral bracts of the former vs. usually undeveloped leaves and pseudolateral inflorescence bearing a single involucral bract of the latter) are not consistent within the two genera. Many species in *Schoenoplectus*, e.g., *S. etuberculatus*, *S. pungens*, *S. torreyi*, and *S. smithii*, produce well-developed, elongate blades and typically bear more than a single involucral bract, although they are sometimes reduced. The lowest involucral bract in *Bolboschoenus* is typically erect both at anthesis and in reduced forms, appearing as a continuation of the culm. Only at maturity does the inflorescence spread out and appear terminal. The Asian species *Schoenoplectus grossus*, which Goetghebeur and Simpson have applied to *Actinoscirpus*, has an inflorescence that appears terminal subtended by several involucral bracts as in *Bolboschoenus*, but the floral morphology is that of *Schoenoplectus*. Furthermore, another Asian species, *Bolboschoenus planiculmis*, has a pseudolateral inflorescence, the lower involucral bract appearing as a continuation of the culm as in *Schoenoplectus*, but the floral morphology is that of *Bolboschoenus*. Therefore, because these two groups share a number of significant characters, I cannot justify the separation of these plants into distinct genera.

Schoenoplectus purshianus (Fernald) M. T. Strong, comb. nov. Basionym: *Scirpus purshianus* Fernald, Rhodora 44: 479. 1942, nom. nov. for *Scirpus debilis* Pursh, Fl. Amer. Sept. 1: 55. 1813, non *Scirpus debilis* Lamarck, Tabl. Encycl. 1: 141. 1791. *Scirpus erectus* var. *debilis* Camus, Fl. Gén. Indo-Chine 7:

136. 1912. *Schoenoplectus juncoides* subsp. *purshianus* (Fernald) Soják, Čas. Nár. Mus. Odd. Přír. 141: 62. 1972. TYPE: U.S.A. Pennsylvania: in wet meadows, *Herbarium Muhlenberg s.n.* (lectotype, as designated on sheet by Schuyler, PH not seen).

Schoenoplectus fluviatilis (Torrey) M. T. Strong, comb. nov. Basionym: *Scirpus maritimus* L. *β ? fluviatilis* Torrey, Ann. Lyceum Nat. Hist. New York 3: 324. 1826. *Scirpus fluviatilis* (Torrey) A. Gray, Manual Bot. N. United States: 527. 1848. *Bolboschoenus fluviatilis* (Torrey) Soják, Čas. Nár. Mus. Odd. Přír. 141: 62. 1972. TYPE: U.S.A. Missouri: banks of the Missouri River, *Baldwin s.n.* (lectotype, selected here, NY).

Schoenoplectus novae-angliae (Britton) M. T. Strong, comb. nov. Basionym: *Scirpus novae-angliae* Britton, Illus. Fl. 3: 509. 1898. *Scirpus campestris* var. *novae-angliae* (Britton) Fernald, Rhodora 8: 136. 1906. *Scirpus robustus* var. *novae-angliae* (Britton) Beetle, Amer. J. Bot. 29: 82. 1942. TYPE: U.S.A. Connecticut: Fairfield, in a freshwater marsh bordering creek, tidewater setting back to this point, *Eames*, 19 July 1896 (holotype, NY; isotypes, NY, US).

Scirpus maritimus γ cylindricus Torrey, Ann. Lyceum Nat. Hist. New York 3: 325. 1836. Syn. nov. *Scirpus cylindricus* (Torrey) Britton, Trans. New York Acad. Sci. 11: 79. 1892, nom. illeg., non *Scirpus cylindricus* (Vahl) Lamarck, Encyl. Method. Vol. 5 (suppl.): 101. 1817. *Scirpus subterminalis* var. *cylindricus* (Torrey) T. Koyama, Canad. J. Bot. 40: 930. 1962. TYPE: U.S.A. Georgia: *Baldwin s.n.* (holotype, PH; spikelet of type, NY).

Schoenoplectus robustus (Pursh) M. T. Strong, comb. nov. Basionym: *Scirpus robustus* Pursh, Fl. Amer. Sept. 1: 56. 1816 (based on *Scirpus maritimus β macrostachyos* Michaux, Fl. Amer. 1: 32. 1803, non *Scirpus macrostachyos* Lamarck, Tabl. Encycl. 1: 142. 1791). *Scirpus maritimus* var. *robustus* (Pursh) Kükenthal, Repert. Spec. Nov. Regni. Veg. 23: 200. 1926. *Bolboschoenus robustus* (Pursh) Soják, Čas. Nár. Mus. Odd. Přír. 141: 63. 1972. TYPE: U.S.A. Carolina: in salt marsh, *Herbarium Michaux s.n.* (lectotype, selected by Schuyler (Ewan, 1979), P not seen).

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A New Species of *Dioscorea* (Dioscoreaceae) from Mesoamerica

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ABSTRACT. A new species from Mexico, *Dioscorea mesoamericana*, is described and illustrated. The new species is distinguished from *D. pumicicola* by its shorter pistillate inflorescences, the amorphous and geometrically fissured bark on the rhizome, and by the different geographical and altitudinal distribution. A key to separate the species, geographical distribution, ecological notes, and a detailed description of nervation patterns are given.

While reviewing a number of collections at the Gray Herbarium (GH) for the treatment of Dioscoreaceae for the *Flora Mesoamericana* project during 1987, the senior author found an interesting collection of an undescribed species in fruit from the state of Oaxaca, Mexico. This species was not included in that treatment of the Dioscoreaceae because of the lack of staminate material and because its distribution was thought to be outside the limits of that project. However, recently this same species was found by the junior author in the state of Chiapas, Mexico. Furthermore, staminate material of the species was obtained, so that it is now possible to confidently describe this new species.

Dioscorea mesoamericana O. Téllez-Valdés & Martínez-Rodríguez, sp. nov. TYPE: Mexico. Chiapas: Municipio Tonala, Cerro de Tres Picos, 15°58′N, 93°36′W, alt. 350 m, 23 jun. 1992 (♂♀), *I. A. Martínez R., I. Sánchez G., M. A. Otero & C. G. Montes C. 5190* (holotype, MEXU; isotypes, ENCB, MO). Figure 1.

Caules dextrorsum volubiles. Folia (6–)9–24 cm longa, (6–)9–24 cm lata, 3-lobata, ovato-lanceolata vel suborbiculata, (7–)9–11-nervata; perianthium purpuratum; stamina 6. Inflorescentia pistillata racemosa 3–5 cm longa, pedunculo 5 mm longo. Capsulae 1.2–1.8 cm longae, 1.4–2.0 cm latae; semina 6–7 mm longa, 4.5–5 mm lata, circumcirca alata.

Twining herbaceous vine. Rhizomes hypogeous, amorphous, growing horizontally, lobed; bark light brown, fissured to slightly angled, the inner bark white. Stems dextrorsely twisting, sometimes with short brachyblasts sharing groups of leaves at the apex. Blades (6–)9–24 cm long, (6–)9–24 cm wide, 3-lobed, ovate-lanceolate to suborbicular, hirsutulous, (7–)9–11-nerved, the base rounded, cordate, the basal sinus campanulate, the apex acute; petiole 1.7–4.5 cm long. Staminate inflorescence paniculate, with cymose branches 5–20 cm long; floral bract 2 mm long, one per flower, ovate-lanceolate, acuminate; flowers 2–3, arranged in a cymule, sessile or pedicellate, the pedicels 1.5 mm long; perianth purple, the tepals 2 mm long, patent; stamens 6, 0.1–0.2 mm long, antrorse, inserted at the torus; pistillode 0.1–0.3 mm, showing different stages of abortion, from inconspicuously trifid to conic. Pistillate inflorescence a raceme 3–5 cm long; peduncles 5 mm long; staminodia 6, 0.1 mm long, inserted at the torus; stylar column 0.3 mm high; styles umbraculate or festoneate. Capsules 1.2–1.8 cm long, 1.4–2.0 cm wide, suborbicular to subquadrate, the base and apex retuse to rounded; seeds 6–7 mm long, 4.5–5 mm wide, oblong to subquadrate, rusty, winged all around, 2 by locule.

Distribution. Dioscorea mesoamericana is endemic to the region of the Isthmus of Tehuantepec at the boundary of the states of Oaxaca and Chiapas in Mexico. It occurs in tropical deciduous and semideciduous forests, as well as nearby riparian forest. It ranges from 100 to 400 m altitude. The soils in which it grows are characteristically black, rocky, with a high organic content. Flowering and fruiting occurs between June and September.

As part of a monographic study of the genus *Dioscorea* for Mexico, Central America, and eventually all the Americas, a general survey of *Dioscorea* characters using several techniques is being carried out. One of these is the description of the venation pattern of *Dioscorea* leaves. Because leaf venation pattern has taxonomic significance, we include a brief description according to outline of leaf-architectural characters described by Hickey (1973) and adapted for monocots by Howard (1983). The

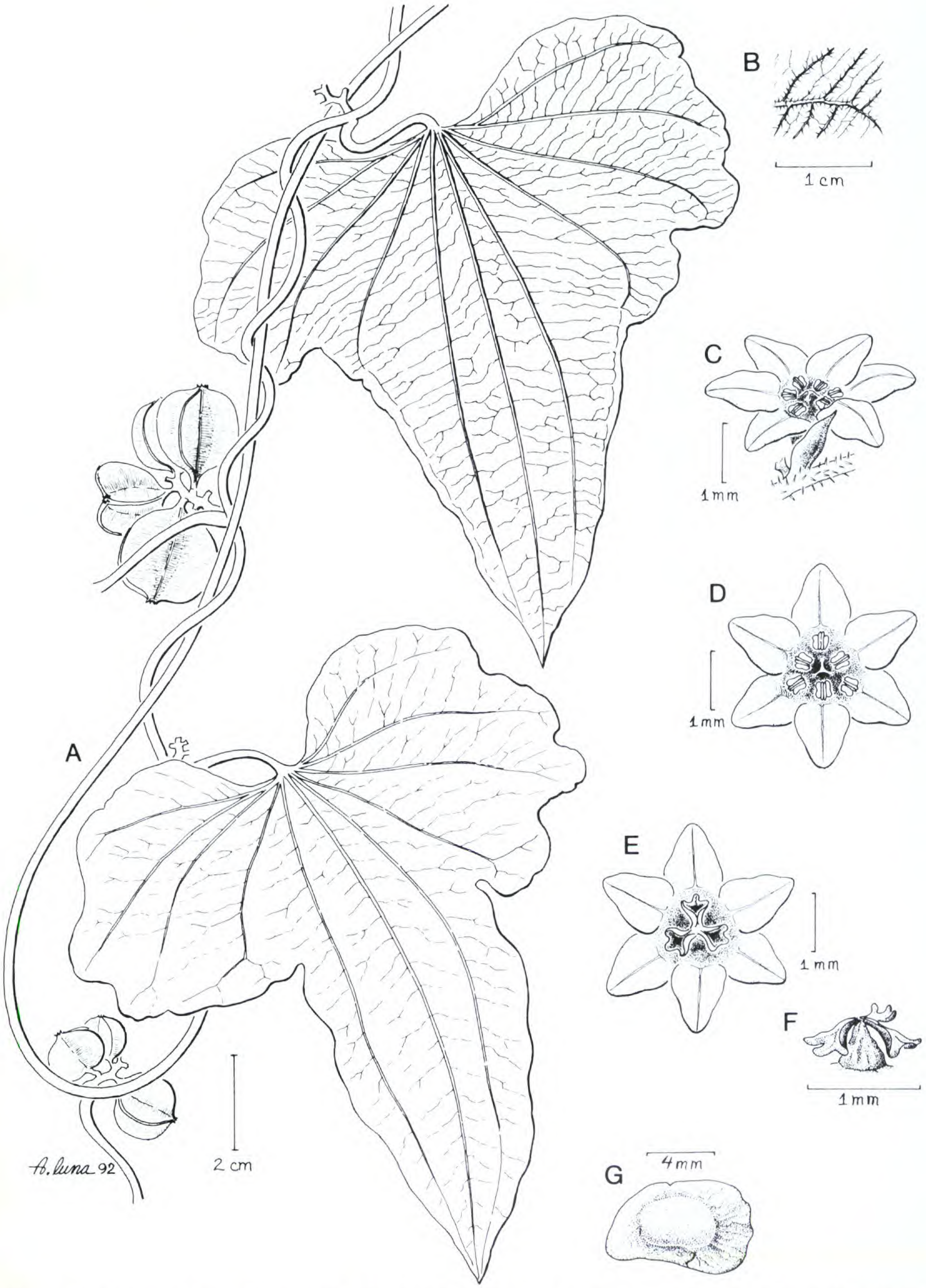

Figure 1. *Dioscorea mesoamericana* O. Téllez-Valdés & Martínez-Rodríguez. —A. Pistillate plant habit, showing the dextrorse stems and the short infructescences. —B. Detail of leaf pubescence. —C, D. Staminate flower, two views. —E. Pistillate flower. —F. Stylar column, showing styles. —G. Winged seed (all from *Martínez-Rodríguez et al. 5190*).

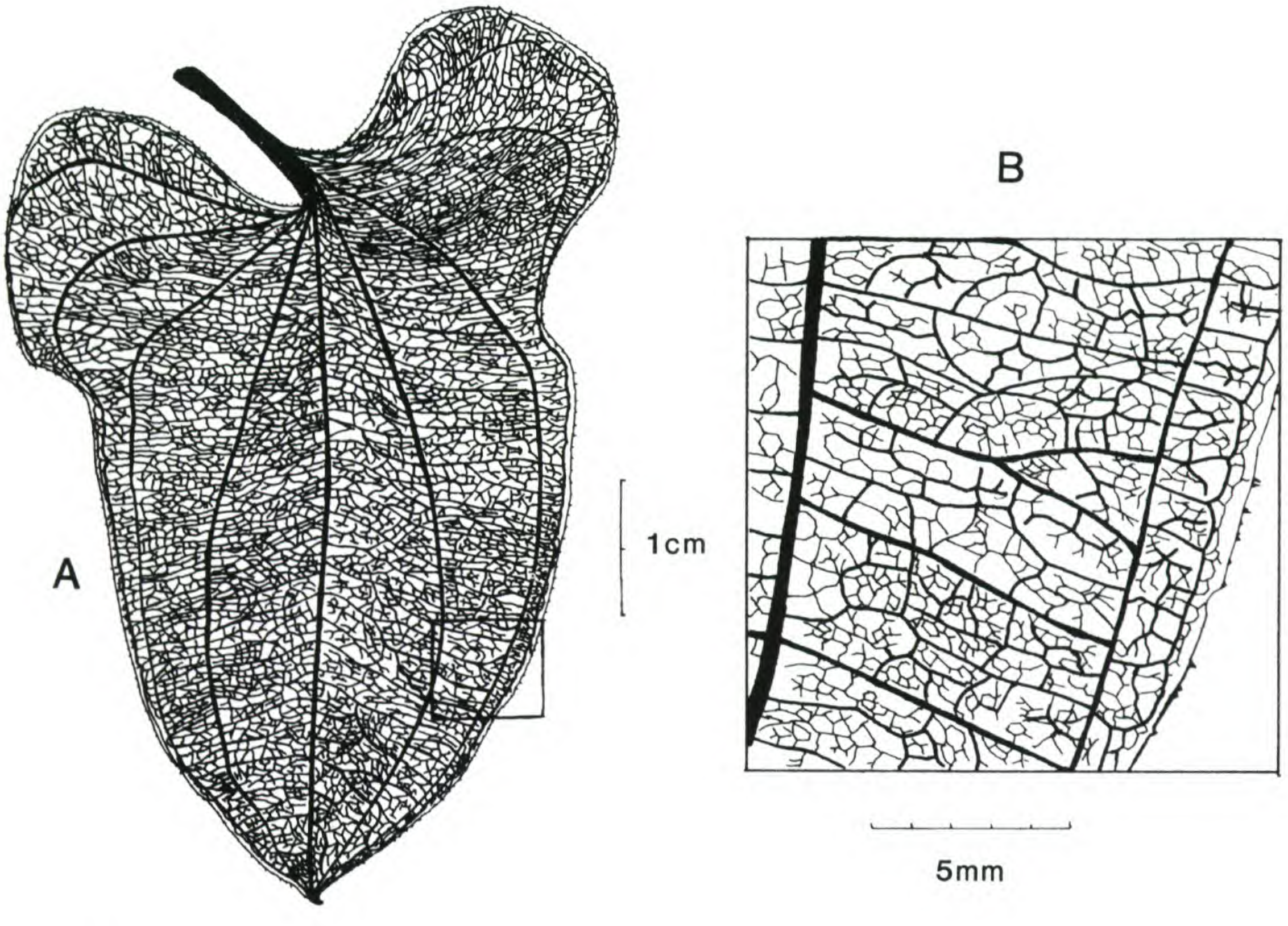

Figure 2. *Dioscorea mesoamericana* O. Téllez-Valdés & Martínez-Rodríguez. —A. Leaf venation pattern. —B. Detail of primary and secondary veins. —C, D. Areoles and higher-order vein variation. —E, F. Ultimate marginal nervation (all from *De Long 16* (Coll. *1038*)).

clearing technique followed is the one proposed in Radford et al. (1974). Whole leaves and higher-order veins were photographed with Panatomic X and Gold Kodakolor (100 ISO) films. Drawings were made from these photographs.

The leaves are dorsiventrally oriented; the texture is membranaceous to slightly chartaceous; the petiole is normal, with the proximal and distal ends (pulvinulous) inflated. The primary venation pattern is campylodromous (Fig. 2A) with an acropetal weakening of the primary veins very pronounced; the size of the primary veins is weak (1.1%), from straight to slightly curved; there is the tendency for primary veins to anastomose apically with one another. Secondary veins arise from the admedial primary vein in a pinnate arrangement, or they extend across the panel and fuse with the exmedial primary, or they may ramify and end blindly, with moderate thickness, and run straightforward (Fig. 2B). Tertiary veins arise at a right angle and branch transversely. Higher(4° and 5°)-order veins are thinner and also arise at a right angle; all (3°, 4°, and 5°) run throughout randomly and/or sometimes orthogonally. The ultimate marginal nervation is looped (Fig. 2E, F). The areoles are usually isodiametric or incompletely closed meshes with no predominant orientation, with a medium (0.3–1 mm) to large (1–2 mm) diameter. Veinlets are simply curved to often once- or twice-branched; the ramifying veinlets have free-vein endings (Fig. 2C, D).

Dioscorea mesoamericana belongs to section *Apodostemon* Uline. It is closely related to *D. pumicicola* Knuth, because they both share the following characteristics: one bract per flower, lobed leaves, and a similar type of pubescence. However, *D. mesoamericana* is distinguished from *D. pumicicola* by its amorphous rhizomes that grow horizontally, and fissured bark that is slightly sculptured by geometrical patterns, as well as by the short infructescences and the different geographic and altitudinal distributions. In contrast, *D. pumicicola* has grouped spherical rhizomes that are linked by narrow necks, its bark is smooth, and the infructescences are longer. *Dioscorea pumicicola* is endemic to the state of Morelos in Mexico. It grows at approximately 1,500 m altitude.

The specific epithet commemorates the international and interinstitutional (MEXU, MO, BM) collaborative effort of the *Flora Mesoamericana* project, which covers all plants of southern Mexico south of Oaxaca and Veracruz, and Central America to the Panamanian–Colombian border.

Artificial Key to the Lobate Species of *Dioscorea* sect. *Apodostemon* in Mesoamerica (Modified from Téllez-Valdés & Schubert, in press)

1a. Leaves, petioles, and rachis of inflorescences glabrous; endemic to Honduras ..... *D. koepperi* Standley

1b. Leaves, petioles, and rachis of inflorescences pilose.

2a. Staminate flowers 1 mm long, light brown, pilose, grouped in compact cymules; pedicels less than 0.7 mm long; 2 bracts per flower; leaves hastate; endemic to Guatemala .. *D. aguilarii* Standley & Steyermark

2b. Staminate flowers 2–3 mm long, purple, glabrous, grouped in spreading cymules; pedicels 1.5 mm long; 1 bract per flower; leaves lobate; endemic to Mexico.

3a. Pistillate inflorescences 3–5 cm long, peduncle 5 mm long; leaf blades (7–) 9–11-nerved ..... *D. mesoamericana* Téllez-Valdés & Martínez-Rodríguez

3b. Pistillate inflorescences 10 cm long, peduncle 4–5 cm long; leaf blades 7-nerved ..... *D. pumicicola* Knuth

Paratypes. MEXICO. **Oaxaca:** Juchitan, *G. R. Delong 16* (♀), (Coll. *1038*, A). **Chiapas:** Arriaga, San Ramon, *A. I. Martínez R. et al. 4331* (♀), *4364* (♀), *4454* (♀), *4860* (FCUNAM, MEXU); Tonala, Cerro de Tres Picos, *A. I. Martínez R. et al. 5061* (♀), *5091* (♀) (FCUNAM, MEXU).

Acknowledgments. We thank Patricia Dávila Aranda and Gerrit Davidse for reviewing the manuscript. We also thank the Development Associates Inc. (US-AID) for financial support for conducting herbaria studies in the United States, Albino Luna for the excellent drawing of the species, and Ana Isabel Bieler Antolín and Alfredo Romero Gamboa (Facultad de Ciencias, UNAM) for assistance with photographing the nerve patterns.

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Cinnamomum kruseanum (Lauraceae), a New Species from Guerrero, Mexico

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ABSTRACT. *Cinnamomum kruseanum* (Lauraceae), collected in the state of Guerrero, Mexico, is described as a new species. The species is illustrated, and its relationships are discussed.

RESUMEN. *Cinnamomum kruseanum* (Lauraceae), colectada en el estado de Guerrero, México, es descrita como una nueva especie. Esta nueva especie es ilustrada, y se discuten sus relaciones con otras especies de *Cinnamomum*.

During the process of identification and curation of H. Kruse's Herbarium, a private plant collection recently acquired by the National Herbarium (MEXU), a number of collections have turned out to be undescribed taxa. One of them is the following new species of *Cinnamomum*.

Cinnamomum kruseanum O. Téllez-Valdés & Villaseñor, sp. nov. TYPE: Mexico. Guerrero: Agua de Obispo, Puente el Mosco, falda este del cerro, alt. 850–900 m, 4 mar. 1961 (fl, fr), *H. Kruse 620* (holotype, MEXU; isotypes, ENCB, MEXU, MO). Figure 1.

Arbor usque ad 3 m alta. Folia 6.3–11.9 cm longa, 3.8–4.8 cm lata, ovato-lanceolata, amplexicaulia, trinervia, apice acuto, cuspidato vel rotundato; basi cordata, superficie adaxiali cinereo-strigulosa vel glabrescenti abaxiali dense cinereo-velutina. Inflorescentiae paniculatae axillares; flores 2–4 mm diam.; tepala 1–2 mm longa, dense minute canescentia; stamina externa et interna oblonga, stipitata; staminodia sagittata, apice apiculato. Fructus 8–10 mm longus, 6–8 mm latus, ellipticus; cupula valde 6 lobata.

Tree to 3 m tall. Stems, leaves, rachis of the inflorescences, pedicels and calyx densely cinereous-strigulose to velutinose. Leaves 6.3–11.9 cm long, 3.8–4.8 cm wide, alternate, blade ovate-lanceolate to sometimes ovate, firmly chartaceous, base cordate, amplexicaulous, with the lobes sometimes overlapping, apex acute to cuspidate to rounded, spreading cinereous-strigulose to glabrescent above, densely cinereous-velutinous below, soft to the touch; petioles 2–4 mm long, stout, cinereous. Inflorescences cymose, up to 13 cm long, axillary; peduncles 3–8 cm long; pedicels 6–13 mm long, slender; flowers 2–3(–4) mm diam. at anthesis; tepals 6, 1–2 mm long, 1 mm wide, ovate-lanceolate, cream to light brown, persistent, densely canescent with short, thick, gray hairs; hypanthium ca. 1 mm long. Outer 6 stamens 1 mm long, oblong, apex rounded, filaments pubescent; anthers quadrate-ovate; inner 3 stamens 1–1.5 mm, the basal pair of glands sessile to subsessile; staminodia 3, ca. 0.5 mm long, deltoid to ovate, sagittate, apex apiculate, hirsutulous. Ovary glabrous; style 1.0 mm, as long as ovary; peduncles 10–15 mm long. Fruits 8–10 mm long, 6–8 mm wide, ellipsoid, dark brown, glabrous; seated in a shallow, strongly 6-lobed, brown, fleshy cupule, the lobes 2 mm long, 2 mm wide, ovate; seeds not seen.

Although the genus *Cinnamomum* Schaeffer is a large, poorly known genus (van der Werff, 1991), its members can be recognized by the cupule subtending the fruit, the tepals frequently persistent and forming a crown on the cupule, and the alternate and triplinerved leaves. Among its members, *C. kruseanum* stands as a distinctive taxon because of its amplexicaul and densely cinereous-velutinous leaves, features not found in any other known Mexican species of the genus.

Following Mez (1889), *Cinnamomum kruseanum* keys out to *Phoebe amplexicaulis* (Chamisso & Schlechtendal) Mez. However, van der Werff (1991) considered all the neotropical *Phoebe* as belonging to *Cinnamomum*. Accordingly, if we follow van der Werff's assumptions, it is not difficult to postulate a relationship between *C. kruseanum* and *P. amplexicaulis*. Both species are readily separated by the pubescent condition of the stems, leaves, and inflorescences of *C. kruseanum* and the glabrous condition of *P. amplexicaulis*. In addition, the former has inflorescences as long as or longer than the leaves, the stamens are oblong, and the staminodia are sagittate, with a sharply apiculate apex, whereas in the latter the inflorescences are shorter than the leaves, the stamens are oblanceolate, and the staminodia are sagittate, with a slightly rounded apex.

The species epithet honors Hubert Kruse, the

Figure 1. *Cinnamomum kruseanum* O. Téllez-Valdés & Villaseñor. —a. Habit showing infructescences. —b. Detail of inflorescence. —c. Flower showing reproductive structures. —d. Staminode. —e. Stamen. —f. Stamen showing basal glands. —g. Ovary. —h. Detail of leaf pubescence (all from *Kruse 620*).

collector of this new species, who, since 1959 and for more than 20 years, made plant collections in the state of Guerrero, especially in the Municipios of Chilpancingo, Tierra Colorada, and Zumpango del Río.

Acknowledgments. We thank Fernando Chiang for critical reading of the manuscript and Francisco Lorea for advice and illustrative comments on Lauraceae. Elvia Esparza provided the drawing.

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Una Nueva *Lissocarpa* (Ebenaceae) de la Amazonía Peruana

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RESUMEN. Se conocen dos especies de la Amazonía Peruana: *L. stenocarpa* se reportó de Perú; *L. jensonii* se describe nueva para la ciencia.

ABSTRACT. In the Peruvian Amazon, there are two known species of *Lissocarpa: L. stenocarpa* is recorded from Peru; *L. jensonii* is here considered as a new species.

Lissocarpa (Lissocarpaceae in Cronquist (1981)), fue reportada por primera vez de Perú, el año 1978, con la colección: *Sidney McDaniel 21628*, Loreto, Maynas, Iquitos, Peña Negra, erróneamente determinada como *Lissocarpa benthamii*. Desde entonces han sucedido varias colecciones cerca del área de Iquitos, identificándolas con dicho nombre; más tarde Steyermark (1987) publicó una nueva especie, *Lissocarpa stenocarpa*, que vino a ser el verdadero nombre para las colecciones del área de Iquitos, que fueron determinadas como *L. benthamii*. Nuevas colecciones al noreste de Iquitos, en Explor Napo Camp, Quebrada Sucusari, indican que existe otra especie de *Lissocarpa*, la cual se la propone como nueva, caracterizada por las ramitas tetrágono-subaladas, nervio medio de la lamina impreso en la haz, fruto subsésil, con el ápice del hipantio crateriforme.

ESPECIES DE *LISSOCARPA* DE LA AMAZONÍA DE PERÚ

1a. Ramitas teretes; nervio medio de la lamina emergente en la haz; fruto pedicelado .... *Lissocarpa stenocarpa*
1b. Ramitas angulosas; nervio medio de la lamina impreso en la haz; fruto subsésil .... *Lissocarpa jensonii*

Lissocarpa stenocarpa Steyermark. Ann. Missouri Bot. Gard. 74: 104. 1987.

Especímenes examinados. PERU. **Loreto:** Maynas, Iquitos: Peña Negra, *S. McDaniel 21628*, *M. Rimachi 4365* AMAZ, MO, USM, WIS; Puerto Almendras, *R. Vásquez 8064* AMAZ, *9659* MO, USM, *van der Werff 9825* AMAZ, MO, USM; Allpahuayo, *R. Vásquez 5778*, *6193*, *15447*, *15470*, *16659* AMAZ, MO, USM, *van der Werff 10250* AMAZ, MO, USM, *J. Pipoly 12205* AMAZ, MO, USM, *Nina Rumy & J. Ruíz 758* AMAZ, MO; Santa María de Nanay, Mishana, *A. Gentry 26022*, *26158*, *26163* AMAZ, MO, USM, *R. Vásquez 5308* AMAZ, MO, USM.

Lissocarpa jensonii Vásquez, sp. nov. TIPO: Perú. Loreto: Provincia de Maynas, Distrito de Las Amazonas, Quebrada Sucusari, Explor Napo Camp, bosque primario, suelo arcilloso con buen drenaje, 13 abr. 1991, *R. Vásquez & N. Jaramillo 15984* (holótipo, MO; isótipos, AMAZ, USM). Figura 1.

Arbor ca. 18 m alta, glabra; ramulis 4-angulosis-subalatis. Folia sub-coriacea, oblonga vel angusta elliptica, nervo medio supra bene impresso; petiolus 1.5–3 mm longus. Fructibus axillaris 2–3, maturus elliptico-fusiformibus, apice crateriformi; semina 5 vel minus.

Arbol 18 m de alto; ramitas tetrágono-sub-aladas, glabras. Hojas sub-coriáceas, oblongas o estrechamente elípticas, (7.5–)10–16(–18) cm × (3–)4–5(–6) cm, ápice breviacuminado, base subobtusa decurrente en el pecíolo; glabra; haz nítido, con el nervio medio impreso y los secundarios planos a ligeramente emergentes, envés con glándulas generalmente hacia el nervio medio, y más densas en la base; nervios secundarios broquidódromos, difíciles de diferenciar por la presencia de otros nervios intermedios, 14–18(–26) pares dirigidos hacia el borde; pecíolo 1.5–3 mm de largo. Inflorescencias axilares, 2–3 pedicelos florales (el espécimen tipo sólo cuenta con frutos). Frutos elíptico-fusiformes, hipantio glabro, verdoso, 30–40 × 15–20 mm, ápice crateriforme, 1.5–2 × 2–2.5 mm; semillas en forma de media luna ≤ 5 por fruto.

Ecología. Bosque primario no inundable, suelo arcilloso. Fructifica en abril–junio.

Esta especie se diferencia de las tres *Lissocarpa* conocidas, *L. benthamii*, *L. guianensis*, y *L. stenocarpa porque* estas especies tienen ramitas teretes o subteretes, la haz con el nervio medio emergente, frutos con pedicelos delgados, con el ápice del hipantio cerrado o muy ligeramente abierto; mientras que *Lissocarpa jensonii* tiene ramitas tetragono-subaladas; la haz con el nervio medio impreso; frutos subsésiles o con pedicelos muy cortos y crasos, con el ápice del hipantio crateriforme. La presencia de 5 semillas no parece un carácter para designar una nueva jerarquía taxonómica; sería más bien una característica para agregar a la familia.

Dedico esta especie a Peter Jenson, amigo de la Naturaleza Amazónica y desinteresado colaborador

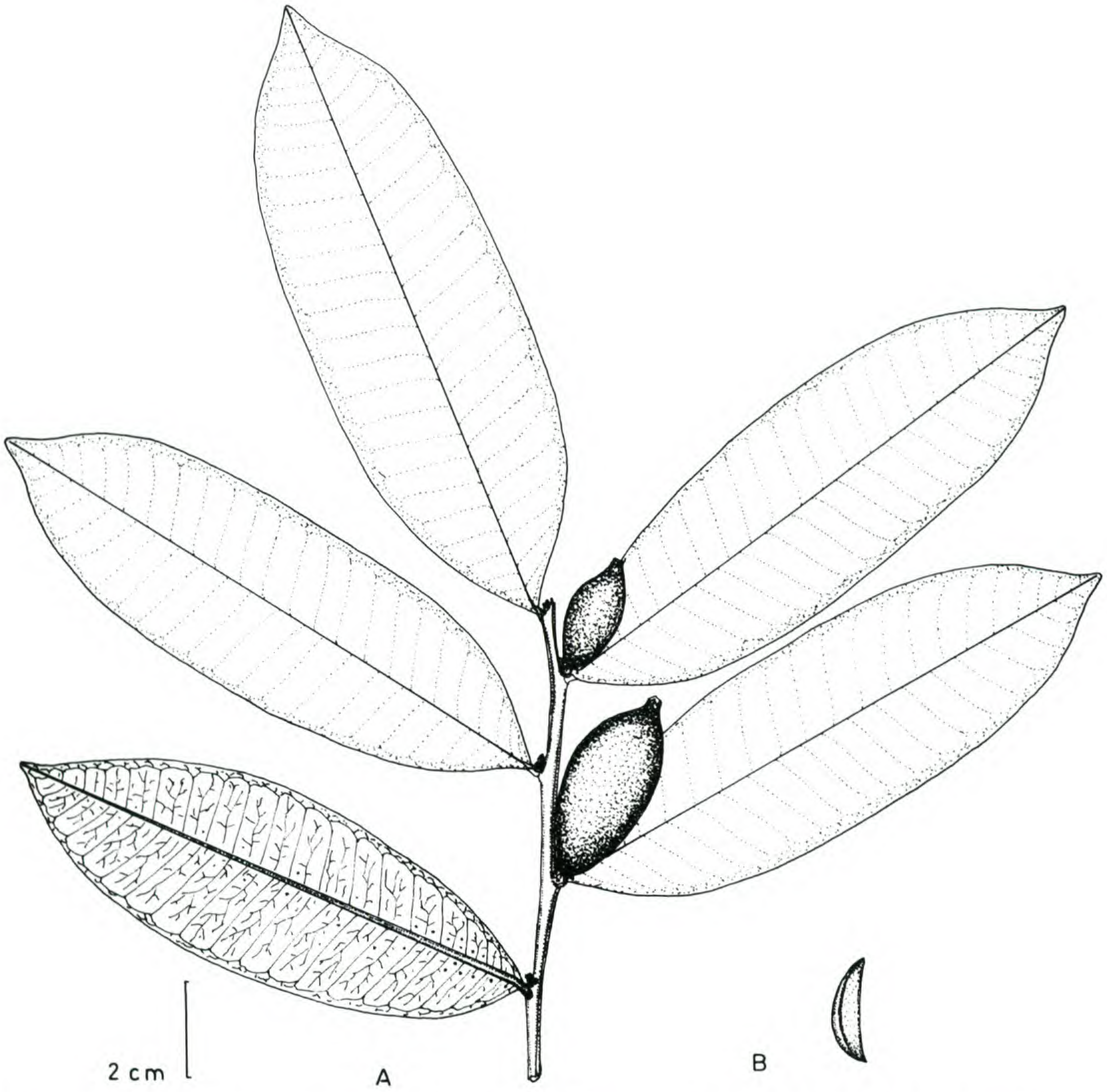

Figura 1. *Lissocarpa jensonii* Vásquez. —A. Hábito. (*Vásquez 15984*, AMAZ, MO, USM.) —B. Semilla.

del Proyecto Flora del Perú, a quien debo que mi trabajo en la selva haya sido más cómodo y provechoso.

Parátipo. PERU. **Loreto:** Provincia de Maynas, Distrito de Las Amazonas, Quebrada Sucusari, Explor Napo Camp, *R. Vásquez et al. 16814* (AMAZ, MO, USM).

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Gerritea, a New Genus of Paniceae (Poaceae: Panicoideae) from South America

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ABSTRACT. *Gerritea pseudopetiolata* of the tribe Paniceae is described and illustrated. Leaf anatomy of this new genus is also included, and relationships with related genera within the Paniceae are discussed.

During fieldwork carried out by T. Killeen in 1987, a previously unknown grass was collected at mid elevation in Bolivia, Department La Paz, between Coroico and Caranavi. Additionally, new specimens, previously collected by S. Beck, were found in the herbarium of LPB.

Gerritea pseudopetiolata Zuloaga, Morrone & Killeen, gen. et sp. nov. TYPE: Bolivia. La Paz: Nor Yungas on road between Caranavi and Coroico, 16°00′S, 67°30′W, 800 m, 25 July 1987, *T. Killeen 2632* (holotype, ISC; isotypes, F, LPB). Figures 1, 2.

Gramen perenne, caespitosum; culmis supra nodis profuse ramificantibus, 60–120 cm longis; nodis pilosis. Foliorum vaginae pilosae vel glabrae, 4–17 cm longae. Ligula inferne membranacea, superne ciliata, 0.3–0.6 mm longa. Lamina lineari-lanceolata, 11–27 cm longa, 0.7–1.5 cm lata, decidua; pseudopetiolo usque 2 cm longo, piloso. Inflorescentiae paniculatae, laxae, diffusae, 14–30 cm longae, 4–12 cm latae. Spiculae ellipsoideae, 1.8–2.2 mm longae, 0.5 mm latae, longe pilosae; quam gluma infera ¾–¼ longitudino spiculae aequans, pilosa, 3-nervia; gluma supera 3-nervia. Anthoecia infera neuter: lemma infera 3-nervia; palea infera 0.7–1 mm longa. Anthoecia supera bisexualia, ellipsoidea, 1.3–1.5 mm longa, 0.4 mm lata, membranacea, decidua, glabra; lemma 3-nervia, palea 2-nervia. Lodiculae 2, conduplicatae, glabrae. Stamina 3.

Caespitose perennial. *Culms* rigid, many noded, procumbent, 60–120 cm long, profusely branching at the upper nodes, internodes 4–9 cm long, finely striate, cylindric, pale or tinged with purple, densely pilose toward the distal portion with whitish, appressed hairs; nodes pilose, covered with whitish, long hairs. Leaves mostly cauline. *Sheaths* longer than the internodes, 4–17 cm long, greenish or tinged with purple, strongly keeled, glabrous or densely papillose-pilose, the margins membranous, ciliate; lower sheaths usually laciniate; auricles small, pilose. *Ligules* 0.3–0.6 mm long, membranous-ciliate, pilose on the abaxial surface, glabrous on the adaxial surface; collar pilose or glabrous, well defined with a transverse brownish line. *Blades* linear-lanceolate, 11–27 cm long, 0.7–1.5 cm wide, flat, with a long pseudopetiole up to 2 cm long, articulated at the base and early deciduous, sparsely pilose, the margins scaberulous, the lower ones ciliate with long whitish hairs or glabrous. Peduncle terete, up to 10 cm long, hirsute. *Inflorescence* a terminal, exserted, panicle, lax, pyramidal, multiflowered, 14–30 cm long, 4–12 cm wide; *main axis* flexuous, hispid, greenish or tinged with purple; pulvini pilose, first-order branches divergent; axis of the branches scabrous, sparsely hispid; pedicels up to 8 mm long, flexuous, scaberulous, sparsely pilose, terete. *Spikelets* solitary, ellipsoid, 1.8–2.2 mm long, 0.5 mm wide, slightly laterally compressed, gaping, greenish or tinged with purple, hispid; upper glume and lower lemma subequal, 3-nerved. *Lower glume* lanceolate, 1.4–1.9 mm long, ¾ to ¼ the length of the spikelet, with papillose-pilose hairs up to 7 mm long toward the margins, acuminate, 3-nerved, with a stipe 0.2 mm long below its insertion. *Upper glume* 1.8–2 mm long, herbaceous, acute, papillose-pilose toward the margins with whitish hairs up to 7 mm long. *Lower lemma* 1.6–1.7 mm long, glumiform, acute, glabrous. *Lower palea* ovate-lanceolate, 0.7–1 mm long, 0.1–0.2 mm wide, membranous, hyaline, the margins scaberulous, 2-nerved; lower flower absent. *Upper anthecium* narrowly ellipsoid, 1.3–1.5 mm long, 0.4 mm wide, glabrous, membranous, smooth, pale, disarticulating at maturity; lemma 3-nerved, the margins flat, not enrolled over the palea; palea 2-nerved, free at its apex; lodicules 2, conduplicate, truncate, 0.2 mm long, embracing the lower margins of the palea; stamens 3, anthers 0.6–0.7 mm long; styles 2, free; stigmas plumose, whitish. *Caryopsis* not seen.

Figure 1. *Gerritea pseudopetiolata* Zuloaga, Morrone & Killeen. —a. Habit, with inflorescence included. —b. Detail of ligule and lower portion of the blade. —c. Spikelet, lower glume view. —d. Spikelet, upper glume view. —e. Lower palea. —f. Upper anthecium, lemma view. —g. Upper anthecium, palea view. —h. Upper palea with lodicules, stamens, and portion of stigmas. Based on *Killeen 2632*.

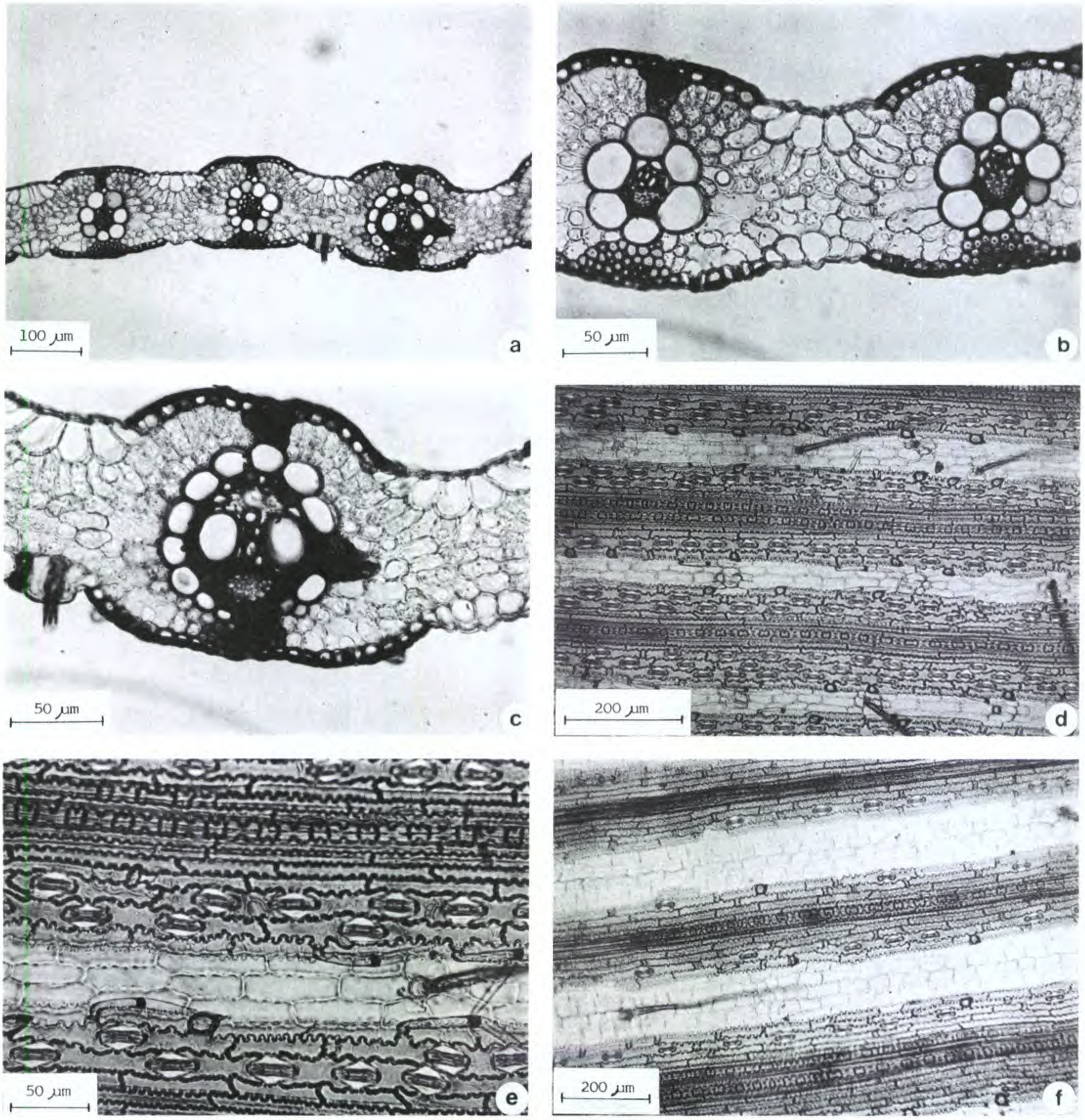

Figure 2. Leaf blade anatomy of *Gerritea pseudopetiolata*. a–c, Transectional anatomy. —a. Transverse section detail showing first- and second-order vascular bundles. —b. Detail showing second-order vascular bundles, bulliform cells, mesophyll cells, and sclerenchyma girders. —c. Detail showing a first-order vascular bundle. —d, e. Abaxial epidermis. —f. Adaxial epidermis. Based on *Killeen 2632*.

Distribution and Ecology

The species has been collected only from a single locality in the "yungas" of La Paz, Bolivia. The type locality is situated on the major highway between the departments of La Paz and the Beni. This area is a small, narrow canyon about 200 m long that is a minor tributary of the Río Coroico. The canyon is notable because of a 40-m waterfall that is located at its upper edge. The vegetation of the area is a semideciduous montane forest; unfortunately, most of the original vegetation has been destroyed due to colonization activities over the past 50 years. This particular site remains relatively unaltered due to very steep slopes that are unsuitable for agriculture.

Plants of *Gerritea pseudopetiolata* are restricted to a relatively narrow band between the road and the waterfall. The microhabitat is moist and well-shaded when compared to the surrounding forest vegetation. Plants are not found in the immediate environs of the waterfall where there is a constant mist, nor do they occur in the disturbed, more open areas in the gorge below the road.

Caespitose individuals are rooted in shallow cracks between rocks or upon a superficial mat of mosses. The rocks are sedimentary slates of probable Ordovician origin; they are hard and resistant to weathering. The species is not locally abundant, and only 11 individuals were observed in 1992. The life form of the species can be described as a lithophytic grass.

Flowering is day-length dependent. The site was visited periodically between 1989 and 1992 and reproductive material was collected only between late June and early July, when days have approximately 11 hours of light. Each culm may produce up to three secondary branches, and most terminal meristems (but not all) produce inflorescences. Occasional culms have a senescent inflorescence, as well as a new inflorescence from a secondary branch produced during the subsequent year. Flowering culms may have as many as 25 internodes or as few as six.

Biogeography

"Yungas" is a Bolivian term describing the humid intermontane valleys of the eastern slope of the Andes. In traditional natural history literature it usually refers to the valleys directly to the northeast of the city of La Paz. This area covers vegetation types ranging from humid tropical forest to semideciduous tropical forest, cloud forest, and tropical montane grassland (the latter probably anthropogenic). The La Paz yungas is the most extensively explored region in Bolivia and has been the focus of numerous collecting expeditions by botanists since the latter part of the 19th century (Funk & Mori, 1989). Numerous endemic species have been described for the La Paz yungas, and a total of 88 species of vascular plants are known (pers. comm., Centro de Datos para la Conservación—Bolivia); of these most are epiphytic orchids (23 species) and bromeliads (20 species). This is the first report of an endemic grass genus for Bolivia. The life form of the species is similar to the more numerous endemic orchids and bromeliads, as it is also a lithophyte.

Paratypes. BOLIVIA. **La Paz:** Nor Yungas, carretera La Paz–Caranavi, 27 km de Caranavi, cañón estrecho cerca de una cascada grande, laderas rocosas, 700 m, 18 June 1989, *Smith & Buddensiek 13515* (LPB, MO, SI); Caranavi, 28 km hacia Coroico, 930 m, 70°W, matorral húmedo sobre rocas, 12 Mar. 1979, *Beck 556* (LPB), 16 July 1979, *Beck 1766* (LPB).

The new genus is named after Gerrit Davidse in recognition of his work on the rich grass flora of the American tropics and his generosity in helping us with the first studies of this new genus. The specific epithet makes reference to the conspicuous pseudopetiolate blades.

Each individual plant of *Gerritea pseudopetiolata* consisted of between 5 and 40 culms arranged in caespitose tussocks. Culms are decumbent and "hang" downward over bare exposed rock; plants do not root at the nodes, even when suitable substrate is available. Culms are long-lived and produce up to 25 internodes; only the upper 4–6 nodes support green foliage. Leaf blades are articulate below the pseudopetiole and early deciduous; the lower nodes are covered by senescent sheaths. Deciduous leaf blades in grasses have been cited by Arber (1934) in *Aristida cyanantha* Steudel ex Trinius and *Agropyron repens* P. Beauvois.

Spikelets are markedly pilose, the hairs up to four times the length of the spikelets. Davidse (1987) suggested that genera with prominent spikelet hairs are probably specialized for dispersal by adhesion and wind; among the genera Davidse mentioned are *Tricholaena* Schultes, *Rhynchelytrum* Nees, and *Leptocoryphium* Nees.

Leaf Blade Anatomy (Figure 2)

Gerritea pseudopetiolata is a non-Kranz, XyMS+ species (following the terminology described by Hattersley & Watson, 1976), characterized by having two bundle sheaths surrounding the vascular bundles, the outer parenchymatous sheath without specialized chloroplasts, and the mesophyll irregularly radiated, with 5–8 mesophyll cells between consecutive vascular bundles (Hattersley & Watson, 1975).

Leaf in transverse section. Outline: open, expanded; leaf thickness at mid-lamina 155–200 μm, leaf thickness 130–160 μm laterally on ribs. *Ribs and furrows:* slightly pronounced; ribs associated with all vascular bundles. *Median vascular bundle:* keel developed; median vascular bundle structurally distinguishable from lateral first-order vascular bundles, solitary or associated with 2 second-order vascular bundles. *Vascular bundle arrangement:* 5 first-order vascular bundles and 24–30 second-order vascular bundles per leaf section; 5–7 second-order vascular bundles between consecutive first-order vascular bundles; all vascular bundles situated in center of blade; 5–8 mesophyll cells between contiguous vascular bundles; with a distance of 165–250 μm between consecutive vascular bundles. *First-order* vascular bundles round in outline; metaxylem vessel elements wide, slightly greater than parenchyma sheath cells, with angular walls; protoxylem vessel and lacunae cavity present; phloem tissue adjoining the inner bundle sheath. *Second-order* vascular bundles angular in outline with xylem and

phloem tissue distinguishable. *Vascular bundle sheaths:* outer first-order bundle sheaths consisting of 8–13 parenchyma cells, with abaxial interruption of sclerenchyma girders; outer second-order bundle sheaths completely surrounding the vascular bundles, with 6–8 parenchyma cells; bundle sheath extensions only present in second-order vascular bundles contiguous to the keel, otherwise absent; parenchyma sheath cells inflated with thin walls and lacking chloroplasts; mestome bundle sheaths completely surrounding the xylem and phloem tissue. *Sclerenchyma:* adaxial and abaxial girders associated with first- and second-order vascular bundles. *Mesophyll:* chlorenchyma irregularly radiated in two layers around the vascular bundles in the adaxial surface; adaxial cells tend to a palisadelike type of arrangement in the adaxial chlorenchyma; chlorenchyma cells tabular, raquimorphous or isodiametric, with intercellular air spaces. *Adaxial epidermal cells:* bulliform cells present in adaxial furrows between all vascular bundles, in restricted groups of 4–6 fan-shaped cells; small epidermal cells associated with the ribs; unicellular macrohairs either with raised cushion-bases or inserted between unmodified epidermal cells as seen in section. *Abaxial epidermis:* bulliform cells and macrohairs present in the abaxial furrows, similar to the ones of the adaxial epiderm cells; papillae absent.

ABAXIAL EPIDERMIS

Zonation: costal and intercostal zones distinguishable. *Costal zones:* with 4–7 files of cells. Silica bodies dumbbell-shaped, usually alternating with 1 square cork cell; prickles not observed. *Intercostal cells:* narrow, 10–15 cells wide, *long cells* rectangular in shape, more than three times as long as wide; cells adjoining the costal zones with undulated walls, central cells of the intercostal zones with sinuous walls; *short cells* solitary or paired, irregularly present; silica bodies irregular in outline or cruciform. *Stomata complex* 26–32.5 μm long, 14–18.2 μm wide, in 4 rows in the intercostal zones, subsidiary cells triangular-shaped. *Microhairs* fusiform, 70–98 μm long, bicellular, with walls of the basal cell parallel, thicker than the walls of the distal cells, apex of the distal cell sharply pointed. *Hooks* small, with the bases shorter than the stomata, the barb longer than the base. *Macrohairs* unicellular, 150–315 μm long, the epidermal cells associated with the base. *Papillae* absent.

ADAXIAL EPIDERMIS

Intercostal long and short cells: similar to the ones of the abaxial surface. *Stomata complex* in 2 rows in the intercostal zones. *Microhairs* as in the abaxial epidermis. *Hooks:* intercostal hooks irregularly present. *Macrohairs* similar to the ones of the abaxial surface. *Papillae* absent.

Relationship to Other Genera of the Paniceae

Gerritea belongs to the tribe Paniceae, which includes genera with biflowered spikelets, disarticulating below the glumes and with upper anthecium more or less indurated, the glumes membranous.

Gerritea is distinguished from related genera by the following set of characters: pseudopetiole prominent, up to 2 cm long; blades articulated at the base and deciduous, inflorescence a lax panicle with spikelets long-pilose, laterally compressed, the lower glume ¾ to ¼ the length of the spikelet, 3-nerved; upper glume and lower lemma 3-nerved; lower palea small; upper anthecium disarticulating from the spikelet, membranous, smooth, lemma with flat margins, the palea free toward the tip. *Gerritea* is a non-Kranz genus.

Within the tribe, *Gerritea* is related by different characters to *Panicum* L. and other genera such as *Hymenachne* P. Beauvois, *Triscenia* Grisebach, *Digitaria* Haller, *Ichnanthus* P. Beauvois, and *Tricholaena* (Clayton & Renvoize, 1986; Watson & Dallwitz, 1988; Webster et al., 1989; see Table 1).

Hymenachne differs by its spongy internodes, filled with aerenchyma; panicles spiciform, with primary branches appressed to the main axis, with spikelets secund; spikelets dorsiventrally compressed, with lower glume up to ½ the length of the spikelet, the lower palea absent.

Triscenia is distinguished by its filiform, non-pseudopetiolate leaves, inflorescences contracted, with racemose branches; spikelets dorsiventrally compressed, the lower glume up to ½ the length of the spikelet; lower palea absent, and upper anthecium with the palea not free toward the apex.

Digitaria includes species with inflorescences with secund spikelets; spikelets plano-convex, the lower glume small or absent; upper anthecium cartilaginous, the lemma with margins thinner in texture than the body. The genus comprises Kranz species.

Ichnanthus has inflorescences with primary branches with appressed or spreading secondary branches, with or without secund spikelets; upper anthecium indurated, the lemma with involute margins and with basal scars or appendages, the palea not free toward the tip.

Tricholaena differs by its non-pseudopetiolate leaves, spikelets with the lower glume small, and upper anthecium with the palea not free toward the tip; all species of the genus are Kranz.

TABLE 1. Comparison of *Gerritea* with related genera of the Paniceae. L: laterally compressed; D: dorsiventrally compressed; +: present; −: absent; +/−: present or absent.

	Gerritea	*Digitaria*	*Hymenachne*	*Ichnanthus*	*Panicum*	*Tricholaena*	*Triscenia*
Culms hollow or spongy	hollow	hollow	spongy	hollow	hollow	hollow	hollow
Pseudopetiole	+	−	−	+/−	+/−	−	−
Leaf blades filiform	−	−	−	−	+/−	−	+
Spikelet compression	L	D	D	L	D	L	D
Lower glume length/spikelet length	3/4–1/1	0–1/3	1/2	1/2–1/1	1/6–4/5	1/6	1/2
Lower palea	+	+	−	+	+/−	+	−
Upper anthecium consistency	membranous	cartilaginous	membranous	indurated	indurated/membranous	cartilaginous	membranous
Upper lemma margins	flat	flat	flat	involute	involute/flat	flat	flat
Upper anthecium wings	−	−	−	+	−	−	−
Upper palea free at apex	+	−	+	−	−	−	−
Photosynthetic type	C_3	C_4	C_3	C_3	C_3/C_4	C_3	C_3

Lastly, *Panicum* has species with spikelets dorsiventrally compressed, upper anthecium indurated, the lemma with involute margins and the palea not free at the apex (the only species with upper palea free at the apex is *Panicum discrepans* Doell, which has on the other hand indurated upper anthecia). Membranous upper anthecia are only present in *Panicum* in species of section *Laxa* (A. Hitchcock & Chase) Pilger, such as *P. leptachne* Doell, *P. longum* A. Hitchcock & Chase, *P. pernambucense* (Sprengel) Pilger, and *P. grumosum* Nees (Zuloaga et al., 1992). These species have inflorescences with racemose branches, the spikelets secund, with the palea not free at the apex. *Panicum* includes Kranz and non-Kranz species.

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Una Especie Nueva de *Hansteinia* (Acanthaceae) del Volcán del Tacaná, Chiapas (México)

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RESUMEN. Se describe una especie nueva de *Hansteinia* (Acanthaceae) solamente conocida del volcán del Tacaná, Chiapas, México, que se diferencia del resto de las especies mexicanas por tener inflorescencias espigadas. Su grano de polen es esferoidal, diporado, y con ornamentación equinada que concuerda con la morfología de los granos de polen del género.

ABSTRACT. A new species of *Hansteinia* (Acanthaceae) is described from the Tacaná volcano, Chiapas, Mexico. It differs from the other Mexican species of the genus by its spicate inflorescences. The pollen grains are spheroidal, diporate, and echinately sculptured, in agreement with the pollen morphology of the genus.

Al examinar especímenes de la familia Acanthaceae provenientes del volcán del Tacaná, Chiapas, para *Flora Mesoamericana* se descubrió una especie nueva del género *Hansteinia* (= *Glockeria*), constituido por aproximadamente 14 especies de México, Centroamérica, y norte de Sudamérica. Comúnmente *Hansteinia* presenta inflorescencias paniculadas; a diferencia de las demás especies del género, este nuevo taxon se destaca por sus inflorescencias espigadas.

Hansteinia tacanensis Acosta & Fernández, sp. nov. TIPO: México. Chiapas: on the SE side of Volcán Tacaná above Talquian, municipio of Unión Juárez, elev. 2,200 m, 23 Nov. 1980, *D. E. Breedlove & F. Almeda 47714* (holótipo, MEXU; isótipo, CAS). Figura 1.

Frutex 1.5–2 m altus; caules erecti, dense pubescentes, pilis multiseptatis, longis glandulosis, cum brevibus non glandulosis mixtis. Folia opposita, petiolata; limbus ovato-lanceolatus, apice acuminato, base in petiolum decurrenti, margine integro, ciliato, supra et infra subpubescens, pilis dispersis. Inflorescentiae longae, spicatae. Flores subsessiles vel brevipedicellati. Calyx 5-partitus, laciniis subaequalibus subulatis, pubescentibus. Corolla rubra, extus pubescens, intus glabrata, ventricosa. Stamina 2, exserta; antherae uniloculares. Capsula ellipsoidalis, puberulenta. Semina 4, lentiformia, verrucosa.

Arbusto de 1.5 a 2 m de alto, tallos erectos redondeados, densamente pubescentes, con pelos multiseptados, glandulosos de 0.7–1 mm de largo, mezclados con pelos no glandulosos de 0.02—0.04 cm de longitud. Hojas opuestas, pecioladas, pecíolos de 0.3–4.5 cm de longitud, pubescentes; laminas de 4–12 cm de largo por 2.5–5.5 cm de ancho, ovado-lanceoladas, ápice acuminado, base decurrente sobre el pecíolo, margen entero, ligeramente ciliado, haz y envés puberulentos, cistolitos de ± 0.2 mm de longitud abundantemente esparcidos sobre toda la superficie. Inflorescencias pedunculadas, terminales y axilares, espigadas, de 7–20 cm; pedúnculos redondeados, pubescentes, con dos tipos de pelos, unos de 0.02–0.03 cm de largo, muy

Figura 1. Holótipo de *Hansteinia tacanensis* Acosta & Fernández. —a. Hábito. —b. Flor con los estambres exertos. —c. Fruto con semillas.

densos y otros más esparcidos, multiseptados de 0.05–0.1 cm de longitud; brácteas de 0.5—0.8 cm de largo por 0.2–0.3 cm de ancho, largamente subtriangulares, pubescentes, con el ápice agudo; bracteolas subuladas de 0.3–0.5 cm de largo por 0.1 cm de ancho; el raquis densamente pubescente con pelos cortos, rectos, de 0.02–0.03 cm de largo y pelos glandulares, esparcidos, multiseptados, de 0.05–0.1 cm de largo; en la base de las espigas se presenta un par de hojas más pequeñas que las caulinares, de 0.7–4 cm de largo por 0.4–3 cm de ancho, subpecioladas, base obtusa a redondeada. Flores subsésiles o con pedicelos de 0.1–0.4 cm de largo; segmentos del cáliz 5, subiguales de 0.9–1.2 cm de largo por 0.08–0.1 cm de ancho, subulados, con ápice agudo, pubescentes, con pelos glandulares, multiseptados. Corola roja, bilabiada, de 2–2.5 cm de largo, pubescente en la superficie externa y en la interna glabra; tubo de la corola angosto, de 0.5–0.7 cm de largo por 0.15–0.2 cm de ancho, abruptamente expandido a manera de una garganta ventricosa de 0.9 cm en su parte más ancha, contraída cerca de 0.4 cm bajo el limbo; el labio superior, triangular, entero, de 0.6 cm de largo por 0.5 cm de ancho, con el ápice obtuso, el labio inferior, obovado, con 3 pequeños lóbulos, de hasta 0.1 cm de largo, con el central notablemente más corto. Estambres 2, insertos justo por arriba de donde se amplía el tubo de la corola; filamentos exertos, glabros, de 2.5–2.8 cm de largo; anteras monotecas, dorsifijas, lóculos de 0.3 cm de largo, múticos. Disco verdoso, cilíndrico de 0.1 cm de diámetro. Ovario glabro bilocular, con 2 óvulos por lóculo; estilo glabro, filiforme, de 3.5 cm de largo, estigma subcapitado. Cápsula de aproximadamente 1 cm de longitud, largamente elipsoide, subestipitada, puberulenta, conteniendo 4 semillas lentiformes, hasta de 0.2 cm de diámetro, verrucosas.

Florece de noviembre a enero.

Distribución y hábitat. Se conoce sólo del estado de Chiapas, México, creciendo en el bosque mesófilo de montaña, que se desarrolla en una de las laderas del volcán Tacaná.

Nuestra especie difiere de las especies previamente conocidas del género por sus inflorescencias espigadas; sin embargo, por la notable similitud de hojas y de estructura floral, la corola con el tubo abruptamente ventricoso, y la morfología de los granos de polen (esferoides, diporados, y con ornamentación equinada (Fig. 2), que concuerdan con lo observado por Raj (1961)), se decidió ubicarla dentro de *Hansteinia*.

Cabe destacar que uno de los géneros afines, *Razisea*, presenta también inflorescencias espigadas, pero sus flores de tubo gradualmente ampliado y no abruptamente ventricoso son de forma notablemente diferente. Por otro lado Wood (1988) incluye al género *Hansteinia* como sinónimo de *Habracanthus;* sin embargo, nosotros consideramos que las características tradicionalmente utilizadas para separar a los dos géneros (corolas someramente tetralobadas, generalmente ventricosas en el primero y corolas claramente bilabiadas, con los labios más largos que el tubo de la corola en el segundo) son caracteres que separan en forma natural a ambos géneros, por lo cual pensamos que éstos deben mantenerse independientes.

Por todo lo anteriormente señalado, al parecer *Hansteinia tacanensis* constituye un taxon bien diferenciado.

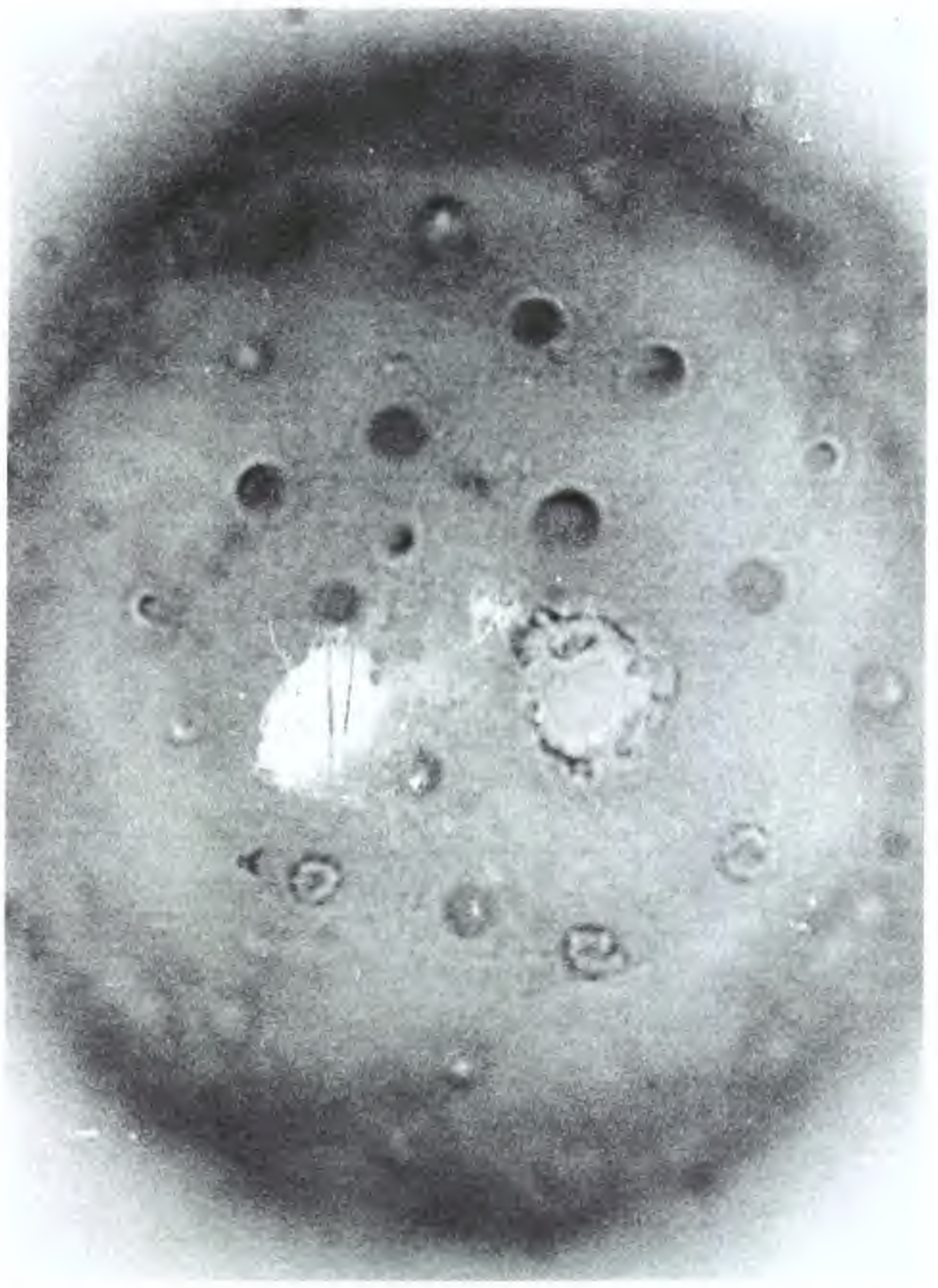

Figura 2. Grano de polen en vista ecuatorial, mostrando los dos poros, ×1,200.

Clave para la Identificación de las Especies Conocidas de *Hansteinia* de Chiapas (México) y Guatemala

1a. Pedúnculos y raquis de las inflorescencias piloso-glandulares.
  2a. Inflorescencias paniculadas; corolas glabras, de color amarillo con bandas rojas, no ventricosa. Chiapas, México; Chimaltenango y Solola, Guatemala ..... *Hansteinia monolopha* (Donnell-Smith) D. Gibson
  2b. Inflorescencias espigadas; corolas pubescentes, de color rojo, ventricosa. Chiapas, México ..... *Hansteinia tacanensis* Acosta & Fernández

1b. Pedúnculos y raquis de las inflorescencias no piloso-glandulares.
3a. Panículas de 5–7 cm de longitud; sépalos lanceolados hojas de 2–3 cm de ancho. Chiapas, México ..... *Hansteinia purpusii* Brandegee
3b. Panículas de 10–15 cm de longitud; sépalos lineares; hojas 3.5–6 cm de ancho. Chiapas, México; Quetzaltenango, Guatemala ..... *Hansteinia glabra* (Leonard) D. Gibson

Por otro lado, es importante señalar que el Volcán Tacaná constituye un sitio de alto endemismo, especialmente en las asociaciones de mayor altitud (Breedlove, 1981).

Paratipo. MEXICO. **Chiapas:** El Talquian Viejo, municipio de Unión Juárez, alt. 1,700 m, 24 enero 1992, *E. Ventura & E. López 10075* (CAS, CHAPA, ENCB, MEXU).

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New Combinations in North American *Asarum* (Aristolochiaceae)

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ABSTRACT. New nomenclatural combinations are needed for some of the North American species of *Asarum* to bring their names in line with the current understanding of relationships in the genus and to provide correct names for a treatment in the *Flora of North America*.

Asarum L., in the broad sense, is a genus of low herbs with creeping stems and a few cordate-reniform leaves. Its flowers have a radially symmetrical, three-lobed calyx, twelve or fifteen stamens, and six styles. Its fruits are fleshy capsules containing many flattened, cordate, arillate seeds. There are about 90 species in *Asarum* s.l. (Araki, 1953; Cheng & Yang, 1983). Most of the species are found in temperate Eastern Asia and the southeastern United States, but a few also occur in Europe, eastern North America, and the Pacific Northwest. It is the only genus in the tribe Asareae and appears to be related to the genus *Saruma* Oliver, a native of China.

Since Braun (1861), a number of sections have been recognized within *Asarum* (Duchartre, 1864; Schmidt, 1935). These are based on the fusion of perianth, the presence of constrictions and annuli in the calyx, the position of stigmas, the length of the anther connectives, the position of the ovary, and the longevity of the leaves. Some of these sections have been raised to generic rank, probably because they appear distinctive within their regional floras. *Hexastylis* Rafinesque of the southeastern United States is one of these. Braun, Duchartre, and Schmidt recognized the same group of species as *Asarum* sect. *Ceratasarum* Braun.

The classification of the species of *Asarum* by Araki (1953) clarified the similarities and differences between the sections. Araki recognized two subgenera in *Asarum:* subg. *Asarum*, distinguished by the sepals being free above the base and forming a pseudotube, and subg. *Heterotropa* (Morren & Decaisne) O. C. Schmidt, distinguished by the sepals being fused into a tube. He placed section *Ceratasarum* (*Hexastylis*) in subgenus *Heterotropa* with sections *Heterotropa* (Morren & Decaisne) Braun and *Asiasarum* (Maekawa) Araki, and he placed the other North American species in subgenus *Asarum*.

The recognition of *Hexastylis* as a genus has persisted in the southeastern United States, in part, because Blomquist overlooked Araki's classification when writing his influential revision of *Hexastylis* (Blomquist, 1957). Also, it is easy to distinguish the species of *Asarum* sect. *Ceratasarum* (*Hexastylis*) from *Asarum canadense* L., the only other species of *Asarum* in the eastern United States.

Blomquist (1957) listed 11 characters that distinguish the groups in eastern North America. Extrorse stamens and bifurcate style extensions define the species in section *Ceratasarum*. The other characters cited by Blomquist are less reliable. The thick, variegated, glabrous leaves that help to distinguish *Hexastylis* in the southeast are similar to those found in many other species of *Asarum* subg. *Heterotropa*, and in *Asarum hartwegii* S. Watson, a species in subgenus *Asarum* native to northwestern North America. *Asarum europaeum* L., the type of *Asarum* and subgenus *Asarum*, has leaves that are evergreen, but not variegated. The tubular calyces are characteristic of all species in subgenus *Heterotropa*, and subgenus *Asarum* sect. *Brevituba* C.Y. Cheng & C. S. Yang is somewhat intermediate in having species with lobes that are fused at the base. Superior to partly inferior ovaries are also found throughout subgenus *Heterotropa*. Short, blunt extensions on the anther connectives and attenuated calyx lobes are found in many species of *Asarum*, though the tendency is for the extensions of species in subgenus *Heterotropa* to be shorter. Finally, short staminal filaments are also found in all sections of subgenus *Heterotropa* with the exception of section *Asiasarum* (Maekawa) Araki.

Recognition of a broadly defined *Asarum* is in accord with some of the major treatments of the genus. Cheng & Yang (1983) used the broad concept of *Asarum* in their treatments of the Chinese species. Owhi (1965) and Hatusima & Yamahata (1988) used it in their treatments of the Japanese species. In addition, the recognition of a broadly defined *Asarum* is consistent with the generic concepts of the other large genera in the Aristolochiaceae (i.e., *Aristolochia* (Schmidt, 1935; Pfeifer, 1966; Ma, 1989), *Thottea* (Ding Hou, 1981)).

With the recognition of *Asarum* in the broad sense, the following new combinations are necessary.

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The other species segregated in *Hexastylis* either already have valid names in *Asarum* or are considered synonyms.

Asarum arifolium Michaux var. **ruthii** (Ashe) Barringer, comb. nov. Basionym: *Asarum ruthii* Ashe, Bot. Contr. My Herb. 1: 4. 1897. *Hexastylis ruthii* (Ashe) Small, Fl. S.E. U.S. 1132. 1903. *Hexastylis arifolia* var. *ruthii* (Ashe) H. Blomquist, Brittonia 8: 268. 1957. TYPE: U.S.A. Tennessee: Knox Co., July 1896, *Ruth s.n.* (lectotype, here designated, NY).

Ashe (1897a) originally published *Asarum ruthii* in a pamphlet entitled *Botanical Contributions from My Herbarium. No. 1*, dated 28 Oct. 1897. A later publication drawn from that separate (Ashe, 1897b) cited the earlier publication as the protologue for his names. Blomquist (1957) overlooked the earlier pamphlet, citing the later as the source of the names, but the earlier pamphlet is effectively published according to the *Code* (Greuter et al., 1988) and must be used despite its obscurity.

Ashe (1897a) did not designate a type in the protologue, but listed his herbarium numbers *1983*, *2011*, and *2015*. In the later paper (Ashe, 1897b) he noted the type locality as Morristown, Tennessee. No Ashe specimens were found that correspond with either the numbers cited or the locality. No Ruth specimens are known from this locality, because the original Ruth material burned in 1934 (Anonymous, 1934). As a lectotype, the Ruth collection from Knox County, Tennessee, in 1896 corresponds to the protologue and is the extant collection most likely to have been seen by Ashe prior to publication.

Plants of variety *ruthii* have generally occurred west of the Appalachian Mountains in Tennessee and Kentucky. They have calyx lobes that are shorter and more erect than the typical variety found east of the range.

Asarum arifolium Michaux var. **callifolium** (Small) Barringer, comb. nov. Basionym: *Asarum callifolium* Small, Bull. Torrey Bot. Club 24: 334. 1897. *Hexastylis arifolia* var. *callifolia* (Small) H. Blomquist, Brittonia 8: 268. 1957. TYPE: U.S.A. Florida: shady woods, *Chapman s.n.* (holotype, NY).

Blomquist (1957) and Gaddy (1987b) showed that *Asarum callifolium* Small is a large-flowered, Gulf Coast variety of the widespread *A. arifolium* Michaux.

Asarum contractum (H. Blomquist) Barringer, comb. nov. Basionym: *Hexastylis contracta* H. Blomquist, Brittonia 8: 279. 1957. TYPE: U.S.A. North Carolina: Buncombe Co., Broad River, between Old Fort and Bat Cave, 4 June 1951, *Godfrey & Anderson 51225* (holotype, DUKE; isotype, NCS).

Hexastylis rhombiformis Gaddy, Brittonia 38: 82. 1986. TYPE: U.S.A. North Carolina: Transylvania Co., North Fork of the French Broad River, ca. 6 mi. NNW of Rosman, 22 Apr. 1982, *Gaddy 250* (holotype, CLEMS).

Flowers of *Asarum contractum* are variable in size and shape. Gaddy (1986, 1987b) segregated plants with prominent reticulation inside the calyx and the broadest part of the calyx above the middle into *Hexastylis rhombiformis* Gaddy. However, the photograph accompanying the original description clearly shows flowers of *H. rhombiformis* with the shape of typical *A. contractum*. Blomquist was aware of this variability in *A. contractum* and included both extremes in his figures 7 and 8 (Blomquist, 1957). Gaddy (1987b) pointed out the unusual distribution of *A. contractum*, but *H. rhombiformis* is sympatric with *A. contractum* in acidic woods on the Blue Ridge of western North Carolina. Further study may show this group to be another phase of the variable *A. virginicum* L.

Asarum speciosum (Harper) Barringer, comb. nov. Basionym: *Hexastylis speciosa* Harper, Torreya 24: 77–83. 1924. TYPE: U.S.A. Alabama: Autauga Co., about 2 mi. E of Booth, 18 May 1924, *Harper & Holt s.n.* (lectotype, designated by Blomquist (1957), NY).

Blomquist (1957) compared this species to the Asian species of *Asarum* subg. *Heterotropa* that have a broad mouth and spreading calyx lobes. None of the Asian species is quite like this species, though. In the Asian species, the flare is made up in part of an annulus that constricts the opening of the calyx tube. Such an annulus is absent in *A. speciosa*. Also, the bifid style extensions and stamen connectives without extensions clearly ally *A. speciosa* with section *Ceratasarum*.

Asarum shuttleworthii Britten & Baker var. **harperi** (Gaddy) Barringer, comb. nov. Basionym: *Hexastylis shuttleworthii* (Britten & Baker) Small var. *harperi* Gaddy, Sida 12: 54. 1987. TYPE: U.S.A. Georgia: Madison Co., just N of GA 106, 14.2 mi. NE of Athens, 9 May 1986, *Gaddy s.n.* (holotype, CLEMS; isotypes, GH, MO, NCU, NY).

This variety is known in the horticultural trade under the cultivar name 'Calloway' (Galle, 1984).

It is a bog-growing variety with elongate, rather than short, rhizomes (Gaddy, 1987a).

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Five New Species of *Chusquea* (Poaceae: Bambusoideae) and a New Combination

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ABSTRACT. Five new species, *Chusquea falcata*, *C. subulata*, *C. barbata*, *C. spathacea*, and *C. pulchella*, are described and illustrated. One new combination, *Chusquea attenuata* (Doell in Martius) L. G. Clark, is proposed for a Brazilian species originally described as an *Arundinaria*, based on a vegetative specimen.

During the course of floristic and phylogenetic studies in the neotropical woody bamboo genus *Chusquea* Kunth, I have discovered a number of species new to science, of which five are described here. A previously poorly known species of *Arundinaria* Michaux from Brazil is transferred to *Chusquea*, and the new combination is made.

Chusquea falcata L. G. Clark, sp. nov. TYPE: Ecuador. Loja: Parque Nacional Podocarpus, above Nudo de Cajanuma, wet montane forest around "Centro de Información," 2,800–3,000 m, 14–15 May 1988 (fl), *B. Øllgaard, J. E. Madsen & L. Christensen 74116* (holotype, QCA; isotype, AAU). Figure 1A–D.

Culmi ca. 1–1.5 cm diametro, 1.5–3(6–8) m alti; erecti ad basim, interdum arcuati ad apicem. Folia culmorum 18–32 cm longa, fragilia, glabra; vaginae 17–30 cm longae, (7–)10–20-plo longiores quam lamina; laminae 1.2–2.7 cm longae. Gemma centralis rotundata. Ramificatio infravaginalis; rami subsidiarii cujusquisque nodi 30–60. Folia cujusquisque complementi 3–4; laminae 7.8–20 cm longae, 0.4–0.85 cm latae, ratio long.:lat. = (11–)17.5–35, apice setosae, basi rotundato-attenuatae. Paniculae (5–)7–16 cm longae, angustae. Spiculae (4.6–)5.1–6.5 mm longae, falcatae, nitidae. Glumae 2, squamiformes. Lemmata sterilia 2, mucronata. Lemma fertile 4.3–5.7 mm longum, mucronatum.

Culms ca. 1–1.5 cm diam., 1.5–3(6–8) m tall, erect at base, scandent to arching above. Internodes terete, usually glabrous, sometimes scabrous below the nodes. Culm leaves 18–32 cm long, just surpassing the next node, abaxially glabrous, brittle, eventually deciduous, juncture of sheath and blade abaxially indistinguishable or nearly so; sheaths 17–30 cm long, (7–)10–20 times as long as the blade, the overlapping margin ciliate, not fused at the base; blades 1.2–2.7 cm long, triangular, erect, persistent, adaxially pubescent, apex subulate; girdle 1–3 mm wide, glabrous; inner ligule ca. 0.5 mm long, ciliolate, pubescent. Nodes at mid-culm with the circular central bud subtended by numerous smaller subsidiary buds in a constellate arrangement; sheath scar dipping below the bud/branch complement; supranodal ridge a visible but not prominent line. Branching infravaginal; central branch sometimes developing; leafy subsidiary branches 30–60 per node, 11–27 cm long, sometimes rebranching from the base. Foliage leaves 3–4 per complement; sheaths glabrous, the overlapping margin ciliate, a tuft of cilia present on each side of the sheath apex, cilia ca. 1 mm long; blades 7.8–20 cm long, 0.4–0.85 cm wide, L:W = (11–)17.5–35, adaxially usually glabrous but sometimes hispid toward the base of the midrib, abaxially usually glabrous, sometimes sparsely pilose, not tessellate or only weakly so, apex setose, base rounded-attenuate; pseudopetiole 1.5–2 mm long, adaxially hispidulous, abaxially glabrous; outer ligule a short, usually ciliolate rim, 0.3–0.5 mm long; inner ligule 0.5–0.6 mm long, truncate, abaxially pubescent. Panicles (5–)7–16 cm long, narrow, the base usually either retained within the subtending sheath or just fully exserted; rachis ± flattened at the base, angular above, glabrous, the edges scabrous, the basal bract 1.5–4 mm long, papery, pubescent, ciliate; branches 2–3 cm long at the base, angular, glabrous to scabrid, the lower branches ascending to appressed, the upper branches appressed; pedicels 1–4 mm long, angular, glabrous to scabrid. Spikelets (4.6–)5.1–6.5 mm long, falcate, shiny. Glumes 2, scalelike, obtuse, abaxially sparsely pubescent toward the apex; glume I 0.4–0.9 mm long, ca. ⅛ the spikelet length, 1-nerved; glume II 1–1.8 mm long, ca. ⅙ the spikelet length, 1–3-nerved. Sterile lemmas 2, mucronate, glabrous; sterile lemma I 1.6–2.9 mm long, ca. ½ the spikelet length, 3-nerved; sterile lemma II 2.7–4 mm long, ca. ⅔ the spikelet length, 3- or 5-nerved. Fertile lemma 4.3–5.7 mm long, mucronate, glabrous, 5- or 7-nerved. Palea 4.2–5.3 mm long, subequal to the fertile lemma, bimucronulate, 4-nerved, sulcate only toward the apex, the sulcus scabrous-hispid. Stamens 3; anthers 2.7 mm long. Lodicules 3; anterior pair 2.1 mm long, posterior one 1.8 mm long, all apically ciliate. Fruit unknown.

Distribution. Endemic to upper montane forests and heath scrub in southern Ecuador; (2,400–) 2,800–3,500 m.

Chusquea falcata is characterized by brittle culm leaves that just surpass the next higher node, infravaginal branching, a circular central bud, somewhat narrow foliage leaf blades, narrow panicles, and shiny, falcate spikelets, for which it is named. It is not clear from the label data of the flowering specimens whether any of the flowering events represented a gregarious bloom. *Chusquea falcata* is apparently a narrow endemic from southern Ecuador, a distribution shared by several additional, as yet undescribed, species of *Chusquea.*

Paratypes. ECUADOR. **Azuay:** eastern Cordillera, 4–6 km N of the village of Sevilla de Oro, 6 Aug. 1945 (fl), *Camp E-4764* (NY). **Loja:** Parque Nacional Podocarpus, Cajanuma, Sendero al Mirador, 2,900 m, 1 June 1992, *Clark et al. 1105* (AAU, ISC, MO, QCA, QCNE, US); pass on old road between Loja and Saraguro, about 10 km S of Saraguro, 3,250 m, 3 June 1992, *Clark et al. 1121* (AAU, ISC, MO, QCA, QCNE, US); carretera Loja–Yangana, desvio al Parque Nacional Podocarpus, E del Nudo de Cajanuma, 2,880–3,000 m, 14 Mar. 1989 (fl), *Freire F. 1329* (QCA); Loma del Loro, 6 km S of Saraguro on road to Loja, 3,200 m, 11 Feb. 1985 (fl), *Halling & Andersson 21924* (QCA); carretera Yangana–Toledo, 2,800–3,200 m, 28 dic. 1988 (fl), *Jaramillo 10623* (QCA); Loma del Oro, 2,800–3,250 m, *Jaramillo et al. 8794* (QCA); Parque Nacional Podocarpus, Cajanuma, at Casa de Predesur, 2,850 m, 21–22 Feb. 1985, *Laegaard 53611* (AAU); road Vilcabamba–Valladolid, at pass, 2,800–2,900 m, 28 Feb. 1985 (fl), *Laegaard 53754* (AAU); in pass approximately 10 km S of Saraguro, 3,500 m, 31 Aug. 1985, *Laegaard 55157B* (AAU); Cordillera del Loro, 50 km N of Loja, just before descending toward Saraguro, along road to radar station, 3,000–3,200 m, 8 May 1987 (fl), *van der Werff & Palacios 9410* (QCNE); 12 km S of Saraguro on the road to Loja, just over the pass in an area called "La Bajada del Piche," 3,100 m, 29 May 1980, *Young 142* (US). **Loja/Zamora–Chinchipe:** at pass on road from Zamora to Loja, just above the intersection of the old and new highways, 2,800 m, 31 May 1992, *Clark et al. 1100* (AAU, ISC, MO, QCA, QCNE, US); carretera Loja–El Paso–Zamora, El Paso, 2,800 m, 15 Mar. 1989 (fl), *Freire F. 1365* (QCA). **Zamora–Chinchipe:** road Vilcabamba–Valladolid, Km 5 S of provincial border, 2,400 m, 28 Feb. 1985, *Laegaard 53747* (AAU); along road Loja–Zamora, SW of the pass, 2,800 m, 2 Sep. 1985, *Laegaard 55173A & B* (AAU).

Chusquea subulata L. G. Clark, sp. nov. TYPE: Ecuador. Pichincha: on the road N from Calacali to San José de Niebli, 2,750 m, 2 May 1980 (fl), *S. M. Young 124* (holotype, QCA; isotypes, NY, US). Figure 1E–H.

Culmi (4–)6–8(–10) cm diametro, (3–)7–10 m alti, erecti ad basim, interdum arcuati ad apicem. Folia culmorum 23–47.5 cm longa; vaginae 19–45 cm longae, (5–)10–22.6-plo longiores quam lamina, abaxialiter pubescentes ad basim; laminae 1.3–4 cm longae. Gemma centralis triangularis. Ramificatio extravaginalis; rami subsidiarii cujusquisque nodi 16–30. Folia cujusquisque complementi 4–5; laminae 11–23 cm longae, (0.9–)1.3–2 cm latae, ratio long.: lat. = 8.4–17.4, apice setosae, basi rotundatae vel rotundato-attenuatae. Paniculae (7.5–)10–26 cm longae, angustae. Spiculae (7.2–)8–10 mm longae, pubescentes. Glumae 2, squamiformes. Lemmata sterilia 2, subulata. Lemma fertile (6.6–)7.2–8.6 mm longum, subulatum.

Culms (4–)6–8(–10) cm diam., (3–)7–10 m tall, erect at the base, arching toward the apex. Internodes ± deeply sulcate above the bud/branch complement, glabrous or pubescent. Culm leaves 23–47.5 cm long, the juncture of the sheath and blade abaxially obscure; sheath 19–45 cm long, (5–)10–22.6 times as long as the blades, abaxially usually pubescent toward the base and otherwise glabrous, rarely completely hispid-pubescent, the overlapping margin ciliate, margins not fused at the base; blades 1.3–4 cm long, triangular, erect, persistent, adaxially pubescent, adaxially usually glabrous, rarely hispid-pubescent, the apex subulate or subulate-setose; girdle ca. 3 mm wide, glabrous; inner ligule 1–3 mm long, ciliate, not extending completely to either margin. Nodes with one triangular central bud subtended by several to numerous smaller subsidiary buds in a constellate arrangement; sheath scar dipping slightly below the bud/branch complement. Branching extravaginal; central branch sometimes developing at the upper nodes; leafy subsidiary branches 16–30 per node, 30–50 cm long, sometimes basally rebranching. Foliage leaves 4–5 per complement; sheaths glabrous, rarely hispid-pubescent between the nerves, the overlapping margin ciliate; blades 11–23 cm long, (0.9–)1.3–2 cm wide, L:W = 8.4–17.4, adaxially glabrous, abaxially glabrous or pilose, not tessellate to weakly so, the apex setose, the base rounded to rounded-attenuate; pseudopetiole 2–5 mm long, glabrous; outer ligule 0.7–1(–2) mm long, ciliolate or glabrous; inner ligule 1–4 mm long, usually rounded, abaxially pubescent. Panicles (7.5–)10–26 cm long, the base often retained within the subtending sheath; rachis ± complanate below, becoming angular toward the apex, glabrous, scabrid, or glabrous at the base and scabrous-pubescent toward the apex; branches appressed to ascending, angular, scabrous to short pubescent, the lower ones 3–8 cm long; pedicels 1–3(–4) mm long, angular, scabrous. Spikelets (7.2–)8–10 mm long, linear. Glumes 2, scalelike, acute or obtuse, less than $\frac{1}{10}$ the spikelet length, abaxially pubescent; glume I 0.6–0.8(–1) mm long, usually 1-nerved; glume II 0.8–1(–1.4) mm long, 1-, 2-, or 3-nerved. Sterile lemmas 2, subulate, abaxially

Figure 1. *Chusquea falcata* L. G. Clark and *Chusquea subulata* L. G. Clark. A–D. *Chusquea falcata* (A, B, *Clark et al. 1100*; C, *Camp E-4764*; D, *Jaramillo 10623*). —A. Young node and internode showing the culm leaf, emerging subsidiary branches, and infravaginal branching. —B. Mature branch complement with a developed central

pubescent; sterile lemma I ca. ½ the spikelet length, (3.1–)3.8–4.6 mm long, 3- or 5-nerved; sterile lemma II ca. ⅘ the spikelet length, 5.8–7.7 mm long, 5-nerved. Fertile lemma (6.6–)7.2–8.6 mm long, subulate, abaxially pubescent toward the apex, 7- or 9-nerved. Palea 5.5–6.9 mm long, bimucronulate, ciliate at apex, sulcate only toward the apex, 4- or 6-nerved. Lodicules 3; anterior pair 1.2–1.5 mm long, posterior one 0.8–1.3 mm long, all apically ciliate. Stamens 3; anthers 3.8–5 mm long. Caryopsis 3.5 mm long, dark reddish brown; hilum linear; embryo 0.6 mm long.

Distribution. Often on steep slopes in upper montane forest in central Ecuador with two disjunct populations in the Central Cordillera of Colombia; 2,260–2,800 m.

Distinguished by its strongly subulate sterile and fertile lemmas, for which it is named, *Chusquea subulata* is also characterized by culms usually ca. 6–8 cm in diameter and ca. 7–10 m tall, extravaginal branching, foliage leaf blades 11–23 cm long and more or less ovate toward the base with setose apices, narrow panicles with the branches and pedicels appressed, and spikelets (7.2–)8–10 mm long. This species is similar in many respects to the common *Chusquea scandens* Kunth, and the two species are likely closely related. However, *C. scandens* is easily distinguished by its open panicles with spreading branches and pedicels, and spikelets 5.5–7.7(–8.6) mm long with only mucronate sterile and fertile lemmas. Vegetatively, *C. scandens* is less robust, reaching only 1–2.5 cm in diameter and 2–6(–8) m in height. The foliage leaf blades of *C. scandens* are 6–17 cm long, and more or less lanceolate, and the apex is at most short setose (Clark, unpublished data).

Except for the two disjunct populations in the Central Cordillera of Colombia, *Chusquea subulata* is restricted to central Ecuador. This distribution pattern is analogous to that of *C. albilanata* L. G. Clark & Londoño, which also has most of its populations in central Ecuador, with one disjunct population in the Eastern Cordillera of Colombia (Clark & Londoño, 1991). The two species are not closely related, and at present, no other species of *Chusquea* with this distribution pattern are known.

According to label data, most of the Ecuadorian populations of this species underwent a mass flowering from 1979 to 1980. One of the Colombian populations (*Clark et al. 261*) flowered gregariously at about this time, although the other population (*Clark & Londoño 379*) flowered out of synchrony in 1988. The only other flowering specimen was collected in 1949 (*Acosta-Solis 14459*), which suggests a flowering cycle of about 30 years, but mass flowering of the Imbabura population was not confirmed for the 1979–1980 flowering event. Caryopses are known only from *Clark et al. 261*, and it is not known if the Ecuadorian populations regenerated from seeds or rhizomes.

Paratypes. COLOMBIA. **Quindio:** 13 km above Salento on the road to La Ceja, 2,860 m, 28 Jan. 1988 (fl), *Clark & Londoño 379* (COL, ISC, TULV, US). **Tolima:** Cerro Bravo, road from Manizales to Bogotá, not far from the Caldas border, 2,750 m, 12 Feb. 1982 (fl), *Clark et al. 261* (COL, ISC, US). ECUADOR. **Imbabura:** area Macho–Loma, sección Shanshipamba, 2,500 m, 17 Nov. 1949 (fl), *Acosta-Solis 14459* (US). **Pichincha:** Reserva Geobotánica Pululahua, camino a Lulumbamba, 1,800–3,356 m, 3 Nov. 1987 (fl), *Cerón M. 2567* (ISC); road descending to the crater of Pululahua, about 7 km from the road to Calacali and 5 km from the entrance to the Reserva Geobotánica Pululahua, 2,800 m, 26 Aug. 1992 (fl), *Clark et al. 307* (ISC, QCA, US); old Quito–Santo Domingo road, E of Chiriboga, western slope, 2,560 m, 27 Aug. 1982 (fl), *Clark et al. 315* (ISC, QCA, US); along road between Nono and Nanegal, between Nono and Tandayapa, 8.8 km before Tandayapa, 2,660 m, 16 Dec. 1979 (fl), *Croat 49333* (MO, US); pass between Otavalo and San José de las Minas, 3,000 m, 6 Apr. 1979, *Holm-Nielsen 16798* (QCA); crater of Pululahua, 100 m from the old road, 2,600 m, 5 Apr. 1979 (fl), *Holm-Nielsen 17058* (AAU, QCA); Lloa valley, 2,600 m, 18 May 1980 (fl), *Holm-Nielsen 23521 & 23554* (AAU); growing along the Saloya river at Km 34.5 from Quito and also just above Guarumal bridge, 21 Aug. 1945, *McClure 21412* (US); Quito, in the Parque Alameda, where it is planted in the border of shrubs around the lake, 2,800 m, 23 Oct. 1945, *McClure 21427* (ISC, US); 24 km E of Tandapi on the road from Santo Domingo to Quito, 8,100 ft., 3 Aug. 1980 (fl), *Wunderlin et al. 8709* (AAU, MO—1 sheet); 10 km NW of Nono on road to Nanegal, steep slope next to Alambi River in cloud forest, 2,410 m, 11 Jan. 1980, *Young 52* (QCA, US); 17 km W of Lloa, 27 Jan. 1980 (fl), *Young 58* (QCA, US); 9 km W of the town of Nono on the road to Nanegalito, 2,410 m, 15 June 1980 (fl), *Young 173* (NY, QCA, US); 67 km E of Santo Domingo on the new road to Quito, 2,260 m, 15 June 1980 (fl), *Young 174* (QCA, US).

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branch and a foliage leaf complement. —C. Inflorescence. —D. Spikelet. E–H. *Chusquea subulata* (E, *Cerón 2567*; F, G, *Young 124*; H, *Young 173*). —E. Inflorescence with a subtending foliage leaf. —F. Branch complement showing extravaginal branching. —G. Spikelet. —H. Culm leaf, abaxial view.

Chusquea barbata L. G. Clark, sp. nov. TYPE: Peru. Pasco: Prov. Oxapampa, Serranía de San Matías, W slope, E of Loma Linda, 400–700 m, 15 June 1983 (fl), *A. Gentry, D. Smith & N. Jaramillo 42007* (holotype, MO; isotypes, ISC, US). Figure 2.

Culmi ignoti. Gemma centralis triangularis. Ramificatio extravaginalis; rami subsidiarii cujusquisque nodi 20–25. Laminae foliorum 7.7–11.7 cm longae, 0.6–0.9 cm latae, ratio long.:lat. = 11.8–13.8, apice acuminato-mucronatae, basi rotundato-attenuatae. Inflorescentiae constantes ex 1(–3) spiculis, per 4–6 bracteas subtentis; bracteae curvinerves. Spiculae 9.1–12.1 mm longae. Glumae valde redactae, cupuliformes. Lemmata sterilia 2, scabrida, mucronata, curvinervia. Lemma fertile 9.7–11.1 mm longum, subulatum, barbatum ad medium, pili ca. 1 mm longi, vitrei, rigidi, cinnamomei.

Culms unknown, described as a vine on the label. Internodes 2 mm diam., ca. 24 cm long, terete. Culm leaves unknown. Nodes with a ± triangular central bud subtended by ca. 20–25 subsidiary branches; nodal line dipping somewhat below the branch complement; supranodal ridge ± prominent; nodal region 4–6 mm wide, relatively large. Branching extravaginal; the more robust subsidiary branches 8–12 per node, 35–70 cm long, whiplike, bearing foliage leaves and/or spikelet clusters, the slender, short subsidiary branchlets terminating in spikelets. Foliage leaf sheaths scabrid, the overlapping margin ciliate, the cilia glassy, reddish gold, following the curve of the internode; blades 7.7–11.7 cm long, 0.6–0.9 cm wide, L:W = 11.8–13.8, adaxially and abaxially glabrous, but adaxially one primary nerve next to the midrib prominent and scabrous for nearly the full length, not tessellate, apex acuminate-mucronate, base rounded-attenuate, one margin glabrous, the other minutely serrulate; pseudopetiole 2 mm long, hispidulous; outer ligule 0.7–1 mm long, ciliolate, abaxially hispid-pubescent on the upper 0.6–0.8 mm, this part also usually a darker brown; inner ligule 1–1.5 mm long, rounded, abaxially pubescent. Inflorescence usually consisting of a solitary spikelet terminating a short, slender subsidiary branch, sometimes the branch bearing one or two additional spikelets, the base of the branch covered by the 4–6 small bracts subtending each spikelet; bracts 0.8–3.6 mm long, acute to mucronate, the lateral nerves curving strongly toward the apex, often almost connecting with the adjacent nerve, apparently lacking buds in their axils; internode (pedicel) between the uppermost subtending bract and the spikelet 0.5–1 mm long, glabrous, somewhat ridged. Spikelets 9.1–12.1 mm long, ± laterally compressed. Glumes 2?, minute, apparently present as a glabrous cupule 0.1–0.3 mm long. Sterile lemmas 2, scabrid, mucronate, 7- or 9-nerved, the lateral nerves curving strongly toward the apex; sterile lemma I 4.1–5.7 mm long, ca. ½ the spikelet length; sterile lemma II 5.7–8 mm long, ca. ⅔ the spikelet length. Fertile lemma 9.7–11.1 mm long, subulate, scabrid, 7- or 9-nerved, the lower ½ heavily bearded except along the keel, the hairs ca. 1 mm long, glassy, stiff, reddish gold or dark reddish gold. Palea 8.5–9 mm long, shorter than the fertile lemma, bimucronulate, scabrid, 4- or 6-nerved, weakly 2-keeled, the sulcus with a few scattered glassy hairs. Stamens 3, anthers 3.7–4.4 mm. Lodicules 3; anterior pair 2.4 mm long, basally strongly swollen, apically ciliate, the posterior one 1.8 mm, apparently with one filament adnate on each margin for about ½ the length. Fruit unknown.

This unusual species is known only from the type specimen, and no habitat information is available. In addition to the heavily bearded fertile lemmas, for which the species is named, *C. barbata* possesses two other synapomorphies: the inflorescences of one to three spikelets, and the strongly curving lateral nerves of the bracts and sterile lemmas. The apparent fusion of two of the filaments to the posterior lodicule is also unique, but given the advanced condition of most of the spikelets on the available specimens, it is not possible to confirm the presence of this feature. In this specimen, there are both more robust, well-developed subsidiary branches and slenderer, short subsidiary branches that terminate directly in spikelets (i.e., the "inflorescences"), but it is not known if the two sizes of subsidiary branches are produced during normal vegetative growth.

Correct interpretation of the spikelets and inflorescences of this species is complicated by the apparent reduction in these structures. The single fertile floret and two sterile lemmas are readily recognizable, and disarticulate together as in other species of *Chusquea* (Fig. 2C, arrow). Based on this homology, the small cupule that remains at the apex of the flowering axis is assumed to represent the two reduced glumes. Extreme reduction or loss of the glumes is known in other species of *Chusquea*, such as *C. fendleri* Munro, *C. coronalis* Soderstrom & C. Calderón, and *C. depauperata* Pilger (Clark, 1989). The internode between the subtending bracts and the cupule is the pedicel.

If we accept the structure described above as the spikelet, then the spikelet and the branch it terminates constitute the inflorescence. The four to six small bracts at the base of the branch, subtending the spikelet(s), most likely represent either the cataphylls that normally appear at the base of a subsidiary branch in *Chusquea*, in which case the rest

Figure 2. *Chusquea barbata* L. G. Clark (*Gentry et al. 42007*). —A. Segment of subsidiary branch showing spikelet clusters. —B. Branch complement with foliage leaves. —C. Detail of one spikelet cluster showing two spikelets; arrow indicates line of disarticulation. —D. Subtending spikelet bract showing the curvature of the nerves.

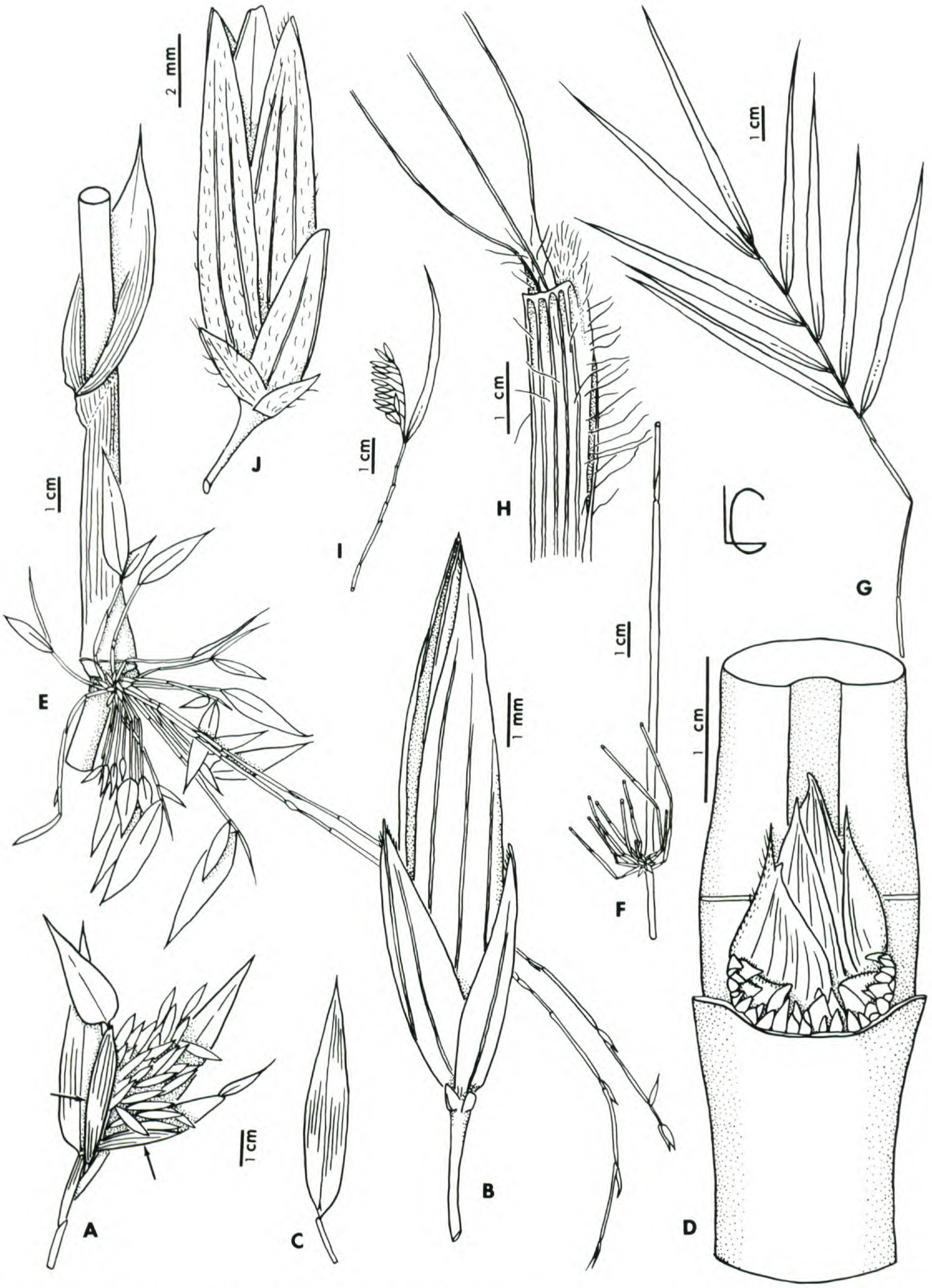

Figure 3. *Chusquea spathacea* McClure ex L. G. Clark and *Chusquea pulchella* L. G. Clark. A–E. *Chusquea spathacea* (A, B, *Haught 4512*; C–E, *Clark & Londoño 588*). —A. Inflorescence showing two subtending spathelike bracts (arrows). —B. Spikelet. —C. Foliage leaf. —D. Bud complement. —E. Node and internode showing the culm leaf, dimorphic subsidiary branches, and infravaginal branching. F–J. *Chusquea pulchella* (F–H, *Clark & Windisch*

of the inflorescence is totally lost, or they may represent the retention of bracts at the base of the inflorescence branches, with concomitant loss of the branches themselves and the peduncle. In the rare cases where one or two additional spikelets are present on a branch, the base of the branch is clothed by two of these bracts, then one or two short spikelet-bearing axes appear in close succession, and then the terminal spikelet subtended by three or four of the bracts is observed. The lateral spikelet(s) is also subtended by three or four bracts. This suggests extreme condensation of all the axes associated with the inflorescence, including the branch upon which it is normally borne. It must be noted that the specimens upon which these observations are based probably represent higher orders of branching, and that the subsidiary branches of the main culm might produce somewhat more elaborated inflorescences. Observations of inflorescence production at higher orders of branching in *C. capituliflora* Trinius and other species, however, indicate that inflorescences produced by the subsidiary branches of the main culm are reiterated more or less faithfully at higher orders of branching.

The possibly plesiomorphous retention of reduced inflorescence bracts is known in *Chusquea* sect. *Longiprophyllae* L. G. Clark (Clark, 1990) and the *Rettbergia* group within *Chusquea* (Clark, unpublished data), although they are not usually as well developed as in *C. barbata*. The racemose inflorescences of *C. simpliciflora* Munro consist of three to four spikelets (Clark, 1989), and may be interpreted as reduction from the more typically paniculate inflorescences of *Chusquea*. Short, sparsely branched paniculate inflorescences with a series of subtending, bractlike leaves are found in *C. tenella* Nees and *C. ramosissima* Lindman (Clark, unpublished data). At present, it seems most parsimonious to assume that the one-spikeleted inflorescences of *C. barbata* represent reduction from the type of inflorescences found in these species, with the retention of at least some inflorescence bracts.

The vining habit and morphology of the bud/branch complement of *C. barbata* suggest an affinity to the *Rettbergia* group. In particular, the shape of the central bud and the dimorphic subsidiary branches are very similar to those of *C. ramosissima*, although that species has infravaginal branching. Although no other species of *Chusquea* exhibit the heavily bearded fertile lemmas of *C. barbata*, short, stiff, glassy hairs on the fertile lemmas (and sometimes also on the sterile lemmas and glumes) are found in a number of species of the *Rettbergia* group, including *C. capituliflora*, *C. capitata* Nees, and *C. urelytra* Hackel. Until additional material becomes available, and this species is studied in more detail, *C. barbata* is tentatively allied with the *Rettbergia* group of *Chusquea*.

Chusquea spathacea McClure ex L. G. Clark, sp. nov. TYPE: Colombia. Magdalena: forest on trail above "Africa" (Sierra Perijá), 1,700 m, 16 Dec. 1944 (fl), *O. Haught 4512* (holotype, COL; isotype, US). Figure 3A–E.

Culmi ca. 1 mm diametro, 2–6 m longi, erecti ad basim, interdum scandentes. Folia culmorum 9.8–19.2 cm longa, glabra, leviter glauca juventute; vaginae 4.5–11 cm longae, 0.85–1.6-plo longiores quam lamina; laminae 4–9 cm longae, cordatae. Gemma centralis triangularis, gemmae subsidiariae dimorphae. Ramificatio infravaginalis; rami subsidiarii robusti cujusquisque nodi 2–3; rami subsidiarii parviores cujusquisque nodi 16–30. Folia cujusquisque complementi 8–12; vaginae plerumque maculatae; laminae 4.6–8 cm longae, 0.8–1.2 cm latae, ratio long.:lat. = 4.7–8, apice breviter setosae, basi rotundatae. Paniculae 2–4 cm longae, secundae, subcontractae, subtentae 2 bracteis spathiformibus. Spiculae 8.8–10.3 mm longae, glabrae. Glumae 2, cupuliformes. Lemmata sterilia 2, mucronata, ad mediam spiculam attingentes. Lemma fertile 7.8–9.4 mm longum, mucronatum.

Culms ca. 1 cm diam., 2–6 m long, erect at the base, scandent and climbing above, sometimes vining. Internodes 13.5–15 cm long, ± terete to shallowly sulcate above the bud/branch complement, glabrous, mottled purple and green, lightly glaucous especially when young. Culm leaves 9.8–19.2 cm long, glabrous, exposed surfaces lightly glaucous when young, juncture of sheath and blade an inverted "V"; sheaths 4.5–11 cm long, 0.85–1.6 times as long as the blades, ± triangular; blades 4–9 cm long, triangular, erect, persistent, base cordate, the margins somewhat ruffled near the base, apex short setose; girdle 0.2–0.5 cm wide, glabrous, a short skirt present at the juncture of the sheath and girdle; inner ligule 3–4 mm long, slightly irregular, apically ciliolate. Nodes with one triangular central bud subtended by 20–25 smaller subsidiary buds and 2–3 larger subsidiary buds in a constellate arrangement; sheath scar dipping slightly below the bud/branch complement; supranodal ridge present but not prominent. Branching infravaginal; central

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726; I, *Davidse et al. 10950*; J, *Clark & Oliveira 939*). —F. Branch complement with culm leaf. —G. Foliage leaf complement. —H. Ligular area of foliage leaf. —I. Inflorescence. —J. Spikelet.

branch often developing; robust subsidiary branches 2–3 per node, 27–50 cm long, whiplike, rebranching, smaller leafy subsidiary branches 16–30 per node, 15–22 cm long, occasionally rebranching, divergent. Foliage leaves 8–12 per complement; sheaths glabrous, often mottled, a few cilia present at the apex of the overlapping margin; blades 4.6–8 cm long, 0.8–1.2 cm wide, L : W = 4.7–8, adaxially glabrous, abaxially glabrous with a tuft of hairs at the base, not tessellate or weakly so, base rounded, apex short setose, one margin glabrous, the other ciliate; pseudopetiole ca. 1 mm long, glabrous; outer ligule 0.2–0.4 mm long; inner ligule 1–1.5 mm long, truncate to rounded. Panicles 2–4 cm long, secund, ± contracted, base retained within the subtending sheath; subtended by usually 2 spatheate bracts, the sheaths 2.4–3.2 cm long, expanded, ± stramineous to translucent at the margins, sometimes slightly mottled, blades 1.3–3.8 cm long, green; rachis triquetrous, glabrous to scabrous-pilose, the edges scabrous; branches secund, angular, scabrous-pubescent, most with a well-developed pulvinus at their bases, spreading, the lower branches 1–1.5 cm long; pedicels 1–2 mm long, angular, scabrous-pubescent, spreading. Spikelets 8.8–10.3 mm long, glabrous, terete or dorsally compressed. Glumes 2, 0.1–0.3 mm long, scalelike, minute, less than $\frac{1}{50}$ the spikelet length. Sterile lemmas 2, ca. $\frac{1}{2}$ the spikelet length, mucronate, 3-nerved; sterile lemma I 3–4.6 mm long; sterile lemma II 3.6–5.1 mm long. Fertile lemma 7.8–9.4 mm long, mucronate, apically ciliate, 7- or 9-nerved. Palea 8.2–9.6 mm long, bimucronulate, 4- or 6-nerved, sulcate for nearly the full length, the sulcus adaxially pubescent toward the apex. Lodicules 3, apically ciliate; anterior pair 2 mm long, basally swollen, the posterior one 1.5 mm long. Stamens 3; anthers 4.6–5.2 mm long. Fruit unknown.

Distribution. Montane forests on the Colombian side of the Sierra de Perijá; 1,700–2,400 m.

Chusquea spathacea is named for the well-developed, spathelike bracts that subtend the inflorescences. From notes deposited at the U. S. National Herbarium, it is clear that F. A. McClure many years ago recognized this as a distinct species and chose the epithet "*spathacea*" for it, although he never formally described the species. Other features that characterize *C. spathacea* include culm leaves with the sheath and blade more or less equal in length and the blade cordate; dimorphic subsidiary buds/branches; infravaginal branching; foliage leaf blades abaxially with a tuft of hairs at the base; contracted panicles; and glabrous spikelets 8.8–10.3 mm long with minute, cupulelike glumes.

The somewhat vining habit, infravaginal branching, and the contracted panicle subtended by spathelike bracts (Fig. 3A, arrows) of *C. spathácea* clearly indicate an affinity with the Brazilian *Rettbergia* group of *Chusquea*. The presence of 1–4 spathelike bracts subtending the inflorescence appears to be a synapomorphy for the *Rettbergia* group (Clark, unpublished data), and thus *C. spathacea* is placed here. *Chusquea pallida* Munro, from northwestern Colombia and Venezuela, also shares these features and therefore is also classified as a member of the *Rettbergia* group.

Paratypes. COLOMBIA. **Cesar:** Mpio. Manaure, Serranía de Perijá, via Manaure–Sabana Rubia, near the Venezuelan border, between Finca Inglaterra and El Cinco, 2,200 m, 24 July 1989, *Clark & Londoño 588* (COL, ISC, K, MO, NY, TULV, US). **Magdalena:** Sierra de Perijá, 8 km ENE of Manaure, 44 km E of Valledupar, 5 km from the Venezuelan border, 2,375 m, 2 Feb. 1945 (fl), *Grant 10772* (ISC, US, WIS).

Chusquea pulchella L. G. Clark, sp. nov. TYPE: Brazil. São Paulo: BR-116, ca. Km 517, heading N to São Paulo, Rio Braço Feio, ca. 60 m before the spring, 560 m, 48°19′W, 24°57′S, 19 Mar. 1991 (fl), *L. Clark & W. Oliveira 939* (holotype, SP; isotypes, ISC, MO, SJRP, US). Figure 3F–J.

Culmi 2–3 mm in diametro, 2–3 m alti, scandentes. Folia culmorum 10–12 cm longa, persistentia; vaginae 9.8–11.2 cm longae, 9.8–12.4-plo longiores quam lamina; laminae 0.9–1 cm longae, triangulares. Ramificatio infravaginalis; ramus centralis evolutus; rami subsidiarii cujusquisque nodi 20–36, 13–40 cm longi. Folia cujusquisque complementi 7–10; vaginae pilosae ad apicem; laminae 3.5–7.1 cm longae, 0.25–0.5 cm latae, ratio long. : lat. = 11.7–14(–24), apice acuminatae, basi attenuatae vel rotundato-attenuatae. Paniculae ca. 2 cm longae, subapertae. Spiculae 5.5–5.8 mm longae. Glumae 2, acutae. Lemmata sterilia 2, acutae vel acuto-mucronatae, inaequales. Lemma fertile 4.7–5 mm longum, obtusum.

Culms 2–3 mm diam., 2–3 m tall, climbing, scandent, often intertwined with other vegetation. Internodes terete, 9.5–15 cm long, glabrous. Culm leaves 10–12 cm long, persistent, juncture of sheath and blade abaxially obscure; sheaths 9.8–11.2 cm long, 9.8–12.4 times as long as the blade, abaxially retrorsely scabrous, the overlapping margin ciliate, not fused at the base; blades 0.9–1 cm long, triangular, erect, persistent, abaxially glabrous, apex subulate; girdle ca. 1 mm wide, pilose; inner ligule not seen. Nodes at mid-culm with the sheath scar ± horizontal but dipping strongly below the bud/branch complement; supranodal ridge obscure. Branching infravaginal; central branch always de-

veloped, as robust as the main culm; leaf subsidiary branches constellate, 20–36 per node, 13–40 cm long, geniculate, sometimes rebranching from the basal nodes. Foliage leaves 7–10 per complement; sheaths pilose toward the apex, often fully pilose at lower branch nodes, a tuft of cilia present on one side at the apex, the overlapping margin ciliate toward the apex; blades 3.5–7.1 cm long, 0.25–0.5 cm wide, L : W = 11.7–14(–24), adaxially glabrous, abaxially tomentose, a tuft of hairs present at the base, not tessellate, apex acuminate, base attenuate to rounded-attenuate, the margins serrulate at the base, becoming nearly ciliate at the apex; pseudopetiole ca. 1 mm long, pilose; outer ligule 0.1–0.2 mm long, glabrous; inner ligule 0.3–0.5 mm long, truncate. Panicles ca. 2 cm long, ± open, just fully exserted from the subtending sheath; rachis ± flattened, hispid-pubescent on the first internode, glabrous above; branches 0.5 cm long at the base, angular, glabrous, ascending, usually subtended by a small bract 0.1–1.3 mm long; pedicels 1–2 mm long, angular, glabrous, often subtended by a minute bract. Spikelets 5.5–5.8 mm long. Glumes 2, acute, abaxially sparsely pubescent; glume I 0.9–1.1 mm long, ca. $\frac{1}{10}$ the spikelet length, 1-nerved; glume II 1.2–1.7 mm long, ca. $\frac{1}{3}$ the spikelet length, 1- or 3-nerved. Sterile lemmas 2, acute to acute-mucronate; sterile lemma I 2.5–2.7 mm long, ca. $\frac{1}{2}$ the spikelet length, sparsely pubescent on the lower half, 3-nerved; sterile lemma II 4.5–5.2 mm long, nearly as long as the spikelet, sparsely pubescent, 5-nerved. Fertile lemma 4.7–5 mm long, blunt, sparsely pubescent, 7-nerved. Palea 5–5.5 mm long, usually overtopping the fertile lemma, blunt, 4- or 6-nerved, sulcate only at the apex, the sulcus scabrous-pubescent. Stamens 3? (spikelets too old to determine the number with certainty); anthers 2.6 mm long. Lodicules 3; anterior pair 1.4 mm long, posterior one 0.9–1.2 mm long. Fruit unknown.

Distribution. Apparently endemic to southeastern Brazil in the state of São Paulo along the Rio Braço Feio in Atlantic forest and secondary forest; 530–680 m.

Chusquea pulchella is a delicate, somewhat viny species characterized by culms 2–3 mm in diameter; 20–36 subsidiary branches per node; 7–10 foliage leaves per complement with pilose sheaths and blades 0.25–0.5 cm wide; spikelets 5.5–5.8 mm long; and unequal sterile lemmas with sterile lemma I about $\frac{1}{2}$ the spikelet length, and sterile lemma II nearly as long as the spikelet. Although this species lacks any spathelike bracts subtending the inflorescence, it is clearly allied with other species of the *Rettbergia* group within *Chusquea* based on its viny habit, infravaginal branching, and spikelet morphology.

This species is very similar to *C. sellowii* Ruprecht and *C. oligophylla* Ruprecht (= *C. discolor* Hackel) in size and habit, and approaches *C. oligophylla* in its nearly ciliate leaf margins. *Chusquea pulchella* can be distinguished easily from these two species, however, by its narrow leaves, 0.25–0.5 cm wide as opposed to 0.8–1.6 cm wide in *C. sellowii* and usually 0.5–1.1 cm wide in *C. oligophylla* (Clark, unpublished data). In addition, the sterile lemmas of *C. pulchella* are strongly unequal, whereas the sterile lemmas in both *C. sellowii* and *C. oligophylla* are subequal or only moderately unequal. The spikelet proportions of *C. pulchella* most closely resemble those of *C. bambusoides* (Raddi) Hackel, but the spikelets of *C. bambusoides* are usually twice as long and the glumes are apically acuminate. Vegetatively, *C. bambusoides* is much more robust, with larger culms, fewer branches per node, and much larger foliage leaves with the blades (1–)1.5–3 cm wide (Clark, unpublished data).

A ten-year flowering cycle is suggested by the two flowering collections of *C. pulchella*, which came from the same population, although a shorter flowering cycle is possible.

Paratypes. BRAZIL. **São Paulo:** BR-116, ca. Km 517, heading N to São Paulo, Rio Braço Feio, ca. 60 m before the spring, 530 m, 4 Mar. 1990, *Clark & Windisch 726* (ISC, MO, SP, SJRP, US); ca. 38 km SW of Jacupiranga along Hwy. 116 to Curitiba, 680 m, 8 Mar. 1976 (fl), *Davidse et al. 10950* (ISC, MO, US).

Chusquea attenuata (Doell in Martius) L. G. Clark, comb. nov. Basionym: *Arundinaria attenuata* Doell in Martius, Fl. Bras. 2(3): 170. 1880. TYPE: Brazil. Minas Gerais: in silvaticis umbr. montis Itacolumi, Aug. 1824, *Riedel s.n.* (holotype, LE; isotypes, KR, US fragment).

McClure (1973: 38) included this species in his list of species excluded from *Arundinaria* as "*4. Arundinaria ? attenuata* Doell; *species sedis mihi incertae etiam nunc manet.*" The type specimen is vegetative, which accounts for his confusion about the placement of this species. However, the photograph of the LE specimen mounted with the fragments that constitute the US isotype clearly shows the circular central bud with several subsidiary branches per node that is characteristic of *Chusquea*. Later collections from Itacolomi (*Chase 9379*, *Macedo 5108*) and Caraça (*Irwin et al. 29242*, *Clark & Morel 714*) match the type perfectly. Both *Macedo 5108* and *Irwin et al. 29242* were collected during the same gregarious flowering event, and the

spikelet morphology confirms that this species is indeed a *Chusquea*, and that the species is distinct. More detailed studies of this species are underway, but *C. attenuata* appears to be restricted to Minas Gerais.

In the original description (Doell in Martius, 1880: 170), Doell indicated that this species represented "*Arundinaria distans ex parte.*" According to a note by Agnes Chase (dated 1936 in her hand) that is attached to the US isotype fragment, the type of *Arundinaria distans* Trinius consisted of four sheets numbered 1 through 4. Sheets 1 and 2 agree with Trinius's description of *A. distans* [= *Colanthelia distans* (Trinius) McClure], but Mrs. Chase stated that Sheet 4 represents a different species that "agrees perfectly with the description of *Arundinaria attenuata* Doell and is undoubtedly the type specimen of that species." No reference was made to Sheet 3. Mrs. Chase also referred to a note made by A. S. Hitchcock during a 1907 visit to St. Petersburg. According to this note, there was a loose annotation label by Doell with Sheet 4 identifying this specimen as *Arundinaria attenuata* Doell. This label apparently was lost subsequently.

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Realignment of *Festuca* Subgenus *Schedonorus* with the Genus *Lolium* (Poaceae)

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ABSTRACT. Evidence from the literature of the close relationship of *Festuca* subg. *Schedonorus* to *Lolium* and its relatively distant relationship to *Festuca* subg. *Festuca* is briefly discussed. New combinations, *Lolium* subg. *Schedonorus*, *Lolium arundinaceum*, *Lolium giganteum*, *Lolium mazzettianum*, and *Lolium pratense*, are proposed to reconcile classification with known phylogeny.

The relationship between *Festuca* L. and *Lolium* L. (Poaceae) has long been an interesting classification problem. *Lolium* is readily distinguished from *Festuca* by its spicate inflorescence and lateral spikelets with a single glume. This morphology suggests the spikelike inflorescence structure in the tribe Triticeae Dumortier, where *Lolium*, in early treatments, was often placed. Nevski (1934) was the first to place *Lolium* in the Poeae (= Festuceae) rather than the Triticeae. Information from diverse nonmorphological sources, such as hybridization and cytology (e.g., Jenkin, 1959), oligosaccharides and water-soluble polysaccharides in caryopses (MacLeod & McCorquodale, 1958), endosperm structure (Tateoka, 1962), seed protein electrophoresis (Bulińska-Rodomska & Lester, 1988; Butkute & Konarev, 1982), serology (Butkute & Konarev, 1980, 1982; Fairbrothers & Johnson, 1961; Smith, 1969; Watson & Knox, 1976), chloroplast DNA (cpDNA) restriction endonuclease site patterns (Lehväslaiho et al., 1987; Soreng et al., 1990), cpDNA reassociation (Hilu & Johnson, 1991), and thermal denaturation of genomic DNA (King & Ingrouille, 1987), has supported the placement of *Lolium* in Poeae.

Spontaneous hybridization occurs commonly between species of *Festuca* subg. *Schedonorus* (P. Beauvois) Petermann and chasmogamous species of *Lolium*, particularly the type species of the genus, *L. perenne* L. (Barker & Stace, 1986; Humphries, 1980; Gymer & Whittington, 1973). Hybridization between *Lolium* and *Festuca* subg. *Festuca* rarely occurs spontaneously and is reported only for *Festuca rubra* L. (Stace, 1975). The latter is, however, also reported to hybridize with species in *Festuca* subgenera *Festuca* and *Schedonorus* as well as *Vulpia* C. C. Gmelin (Ainscough et al., 1986; Knobloch, 1968; Saint-Yves 1929; Stace, 1975). Hybridization between *Festuca* (*Schedonorus*) *pratensis* Hudson and *Lolium perenne* (= ×*Festulolium loliaceum* (Hudson) P. V. Fournier) was suspected as early as 1790 (see Jenkin, 1933). Reproductive barriers are not appreciably greater for this hybridization than for interspecific hybridization within *Festuca* subg. *Schedonorus* or between many species of *Lolium* (Jenkin, 1933; Stace, 1975). The degree of difficulty in producing artificial *L. perenne* × *F. pratensis* hybrids and the differential success of reciprocal crosses is similar to interspecific hybridization reported in various plant genera (e.g., Borrill et al., 1977; Gymer & Whittington, 1973). Extensive studies of artificial hybrids and their chromosome behavior (for references, see Jauhar, 1974, 1975; Terrell, 1966), as well as chromosome banding (Dawe, 1989; Thomas, 1981), have indicated the homology of chromosomes and their genetic compatibility. In auto-allotriploids and amphidiploids of *L. perenne*, *L. multiflorum* L., and *F. pratensis*, synapsis of homeologous chromosomes usually occurs as multivalents or even bivalents, in spite of the presence of true homologues (Jauhar, 1974, 1975). Diploid crosses of these taxa show high bivalent formation (87–100%) with 0.783–0.896 chiasmata per chromosome pair (Jauhar, 1975). Such observations have led many taxonomists and cytogeneticists to suggest that *Festuca* and *Lolium* could be combined, in whole (e.g., Jauhar, 1975; Knobloch, 1963; Löve, 1963; Stebbins, 1956; Terrell, 1966; Ullmann, 1936) or in part (e.g., Tutin, 1956).

Amalgamation of *Festuca* and *Lolium* has been proposed as early as 1898 (M'Alpine, 1898), but no valid combinations of *Festuca* subg. *Schedonorus* taxa within *Lolium* are available. Raspail (1829), however, included *F. pratensis* (under the name *F. elatior* L.) and *F. loliaceum* Hudson (= *F. pratensis* × *L. perenne*) in his examination of *Lolium* as *L. festuca* Raspail and *L. festucoides* Raspail, respectively. Proposed on the basis of morphological and ecological continua observed between these taxa and

species of *Lolium*, Raspail considered this classification physiological rather than taxonomic. Such continua would be expected between hybridizing taxa and their derivatives. Gross morphology and cytological differences between *Festuca* and *Lolium* have been cited as reasons for not combining the genera (Clayton & Renvoize, 1986; Jenkin, 1933; Malik & Thomas, 1966; Raspail, 1829; Terrell, 1968).

Jenkin (1933) acknowledged the close phylogenetic relationship between *Lolium* and *Festuca* subg. *Schedonorus* and the relatively distant relationship of these taxa to *Festuca* subg. *Festuca*. He did not feel, however, that their classification was incumbent on evolutionary relationships. Bulińska-Rodomska & Lester (1988) detected similar relationships in a phenetic analysis of 50 morphological characters when they excluded six that were associated with the spicate inflorescence of *Lolium*. Their principal components analysis identified 11 characters in the first factor axis that separated the two lineages with the exception of *Vulpia alopecuros* (Schousboe) Dumortier. The latter taxon grouped with *Lolium* and *Festuca* subg. *Schedonorus* in the first axis but was clearly separated in the second axis. *Lolium* and *Festuca* subg. *Schedonorus* were not separated by either of the first two components.

Analysis of cpDNA restriction site variation (Darbyshire & Warwick, 1992; Lehväslaiho et al., 1987), chromosome synaptic ability (Jauhar, 1975), seed protein electrophoresis (Bulińska-Rodomska & Lester, 1988), and certain morphological data sets (Bulińska-Rodomska & Lester, 1988; Stebbins, 1956) suggests congeneric status for *Lolium* and *Festuca* subg. *Schedonorus* as a lineage distinct from species of *Festuca* subg. *Festuca*. This is consistent with other nonmorphological studies (Butkute & Konarev, 1980, 1982; Hilu & Johnson, 1991; King & Ingrouille, 1987; MacLeod & McCorquodale, 1958; Smith, 1969; Watson & Knox, 1976). The polyphyletic nature of *Festuca* sensu lato and its relationship to *Lolium* have not always been appreciated in these latter studies, because, for practical reasons, species of *Festuca* subg. *Schedonorus* are frequently used as the sole representatives of the large and diverse genus *Festuca*.

Polyphyly in *Festuca* has been considerably reduced since the concept of Linnaeus. Several groups (including *Vulpia* (Clayton & Renvoize, 1986) and *Hellerochloa* Rauschert (Tzvelev, 1989)), more closely related to *Festuca* subg. *Festuca* than *Festuca* subg. *Schedonorus*, are recognized as separate genera in some recent treatments. Consistent with some morphological interpretations (e.g., Macfarlane & Watson, 1982), cpDNA restriction site data of North American species (Darbyshire & Warwick, 1992) indicate that *Leucopoa* Grisebach (excluding *Festuca* subg. *Leucopoa* sect. *Breviaristatae* Krivotulenko) is also more distantly related to *Festuca* subg. *Festuca* than some of these taxa and should be recognized at the generic level. Inclusion of *Leucopoa* sect. *Leucopoa* in *Festuca* would require the inclusion of *Festuca* subg. *Schedonorus*, *Vulpia*, and *Lolium* for *Festuca* to be monophyletic.

The recognition of *Schedonorus* as a distinct genus seems unwarranted. Excluding the overemphasized inflorescence characters, it is hardly distinguishable from *Lolium* in morphology (Bulińska-Rodomska & Lester, 1988). The symmetrical chromosomes and limited polyploidy in the genus *Lolium* are plesiomorphic character states and cannot be used to define a monophyletic clade. Furthermore, the derived conditions of polyploidy and asymmetrical chromosomes found in *Schedonorus* and other subgenera of *Festuca* are highly homoplastic in grasses and are not irreversible. The reduction of the inflorescence from a panicle to a spike, with concomitant modifications to other reproductive structures, is the only derived morphological or cytological feature uniting species of *Lolium* and distinguishing them from their closest relatives. The trend from panicle to spike or raceme is homoplastic in other taxa of the Poeae and may not be synapomorphic in *Lolium*. Additionally, cpDNA restriction site data indicate less divergence of this genome between *L. perenne* and species of *Festuca* subg. *Schedonorus* than between some members of the *Festuca ovina* L. complex of *Festuca* subg. *Festuca* (Darbyshire & Warwick, 1992).

The accommodation of *Festuca* subg. *Schedonorus* in *Lolium* would require only slight change to published generic descriptions. Several morphological features of *Festuca* subg. *Schedonorus* are consistent with its classification in *Lolium*. Shared characters include wide, flat leaf blades with fascicles of sclerenchyma opposite the veins or forming girders between the epidermes at the major veins (plesiomorphic), entirely glabrous ovary apices (homoplastic in *Festuca* and *Lolium*), caryopses adhering to the paleas (synapomorphic in *Lolium/Schedonorus*, versus free in *Festuca*), subterminal style insertion (synapomorphic in *Schedonorus/Lolium*), and falcate leaf blade auricles (synapomorphic in *Schedonorus/Lolium*, which are not found in any related group).

The Old World taxa, *Festuca* subg. *Montanae* (Hackel) Nyman and *Festuca* sect. *Scariosae* Hackel, are known to be more closely related to *Festuca* subg. *Schedonorus* than *Festuca* subg. *Festuca*. At

least some of the species in these taxa may prove to belong to the clade including *Lolium* and *Festuca* subg. *Schedonorus* as has been suggested by cytological studies (Borrill et al., 1977; Chandrasekharan & Thomas, 1971). The phylogeny is complicated by the apparent alloploids, between diploids of *Festuca* subg. *Schedonorus* and *Festuca* sect. *Scariosae*, seen in polyploid members of the *Festuca arundinacea* Schreber complex in northwest Africa (Borrill, 1972). Failure of meiotic chromosome pairing (1.20 bivalents per cell) in crosses between diploids of *Festuca* subg. *Schedonorus* (*F. pratensis*) and *Festuca* subg. *Montanae* (*F. drymeja* F. K. Mertens & W. D. J. Koch) has been attributed to differences in chromosome size (Morgan et al., 1986). Even lower pairing frequency is observed between diploids of *Festuca* subg. *Schedonorus* (*F. pratensis*) and *Festuca* subg. *Festuca* (*F. polesica* Zapałowicz), although there is much less of a difference in chromosome size (Morgan et al., 1986). If the relationships of *Festuca* subg. *Montanae* and *Festuca* sect. *Scariosae* are with the *Lolium/Schedonorus* rather than the *Festuca* sensu stricto lineage, this will not solve the questions as to whether *Lolium* should be united with, or *Schedonorus* separated from, *Festuca*. Further work may indicate a need to transfer species of *Festuca* subg. *Montanae* and *Festuca* sect. *Scariosae* to *Lolium* or at least to remove them from *Festuca*.

The paniculate inflorescence and the presence of the lower glume are the principal morphological characteristics separating *Festuca* subg. *Schedonorus* from *Lolium* and connecting the former taxon with *Festuca*. These serve as subgeneric characters in the treatment proposed here. Transferring the four species of *Festuca* subg. *Schedonorus* to *Lolium* is a much more practical solution to the obvious difficulties of combining the nomenclature of these two complex Linnaean genera under the caveat of monophyletic classification.

The name *Festuca elatior* L. was lectotypified by Linder (1986), and, although it has priority over *F. arundinacea* Schreber, has been proposed as a *nomina rejicienda* under ICBN Art. 69 by Reveal et al. (1991). The present usage (*F. arundinacea*) is followed here to avoid nomenclatural confusion.

Lolium subg. **Schedonorus** (P. Beauvois) S. J. Darbyshire, comb. nov. Basionym: *Schedonorus* P. Beauvois, Ess. Agrostogr.: 99, 177. 1812. *Festuca* sect. *Schedonorus* (P. Beauvois) W. D. J. Koch, Syn. Fl. Germ. Helv.: 813. 1837. *Festuca* subg. *Schedonorus* (P. Beauvois) Petermann, Deutschl. Fl.: 643. 1849. TYPE: *F. elatior* L. (= *F. arundinacea* Schreber) (lectotype, selected by Niles & Chase (1925)).

Lolium arundinaceum (Schreber) S. J. Darbyshire, comb. nov. Basionym: *Festuca arundinacea* Schreber, Spic. Fl. Lips.: 57. 1771. *Bromus arundinaceus* (Schreber) A. W. Roth, Tent. Fl. Germ. 2: 141. 1789. *Schedonorus arundinaceus* (Schreber) Dumortier, Observ. Gramin. Belg.: 106. 1824. *Festuca elatior* var. *arundinacea* (Schreber) C. F. H. Wimmer, Fl. Schles. Ed. 3: 59. 1857. *Festuca elatior* subsp. *arundinacea* (Schreber) Čelakovský, Prodr. F. Böhmen 1: 51. 1867. TYPE: Scheuchzer, *Agrostographia*, tab. V, fig. 18. 1719 (lectotype, selected by Reveal et al. (1991)).

Lolium giganteum (L.) S. J. Darbyshire, comb. nov. Basionym: *Bromus giganteus* L., Sp. Pl.: 77. 1753. *Festuca gigantea* (L.) Villars, Hist. Pl. Dauph. 2: 110. 1787. *Avena gigantea* (L.) R. A. Salisbury, Prodr. Stirp. Chap. Allerton: 23. 1796. *Schedonorus giganteus* (L.) Gaudin ex J. J. Roemer & J. A. Schultes, Syst. Veg. 2: 644. 1817, as "Schenodorus giganteus" pro syn. *Bromus giganteus* L. *Bucetum giganteum* (L.) Parnell, Grass. Scotland: 108, pl. 47. 1842. *Zerna gigantea* (L.) Panzer ex B. D. Jackson, Index Kew. 2: 1249. 1895. *Forasaccus giganteus* (L.) Bubani, Fl. Pyren. 4: 383. 1901. TYPE: Europae sylvis siccis.

Roemer and Schultes published the name *Lolium giganteum* (Syst. Veg. 2: 750. 1817.) as a synonym of *L. maximum* Willdenow. This name has sometimes been cited *Lolium giganteum* hort. ex Roemer & Schultes as a synonym of *L. temulentum* L. (e.g., Terrell, 1968). According to ICBN Art. 34.1 this name is not validly published and thus the epithet, *giganteum*, is available for the proposed combination.

Lolium mazzettianum (E. B. Alexeev) S. J. Darbyshire, comb. nov. Basionym: *Festuca mazzettiana* E. B. Alexeev, Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 82(3): 99. 1977, nom. nov. pro *Festuca mairei* Hackel ex Handel-Mazzetti, Symb. Sin. 7: 1288. 1936, non Saint-Yves 1922. TYPE: China. Yunnan: talus des Uzuru, 3 June 1908, *Ducloux 867* (lectotype, selected by Alexeev (1977), W).

Lolium pratense (Hudson) S. J. Darbyshire, comb. nov. Basionym: *Festuca pratensis* Hudson, Fl. Angl.: 37. 1762. *Festuca fluitans* var. *pratensis* (Hudson) Hudson, Fl. Angl. Ed. 2: 47. 1778. *Schedonorus pratensis* (Hudson) P. Beauvois, Ess. Agrostogr.: 99, 163, 177. 1812. *Bromus pratensis* (Hudson) K. P. J. Sprengel, Syst. Veg. 1: 359. 1825, non Lamarck 1785. *Lolium festuca* Raspail in Saigey & Raspail, Ann. Sci. Observ. 2: 244. 1829, comb. inval. *Lolium festuca* Raspail ex Mutel, Fl. Franç. 4: 111. 1837, pro syn. *Festuca pratensis* Hudson. *Bucetum pratense* (Hudson) Parnell, Grass. Scotland: 105, pl. 46. 1842. *Festuca elatior* var. *pratensis* (Hudson) A. Gray, Manual Ed. 5: 634. 1867. *Festuca elatior* subsp. *pratensis* (Hudson) Hackel, Bot. Centralbl. 8: 407. 1881. *Tragus pratensis* (Hudson) Panzer ex B. D. Jackson, Index Kew. 2: 1099. 1895. TYPE: Herb. Sloane 125.16 (BM-SL) (lectotype, selected by Reveal et al. (1991)).

Lolium ×festucaceum Link, Linnaea 2: 235. 1827. *Festuca loliacea* Hudson, Fl. Angl.: 38. 1762. *Festuca fluitans* var. *loliacea* (Hudson) Hudson, Fl. Angl. Ed. 2: 47. 1778. *Poa loliacea* (Hudson) Koeler, Descr. Gram.: 207. 1802. *Schedonorus loliaceus* (Hudson) P. Beauvois, Ess. Agrostogr.: 99, 163, 177. 1812. *Festuca pratensis* var. *loliacea* (Hudson) Saint-Amans, Fl. Agen.: 42. 1821. *Brachypodium loliaceum* Link, Hort. Berol. 1: 42. 1827, comb. inval. *Lolium festucoides* Raspail in Saigey & Raspail, Ann. Sci. Observ. 2: 243. 1829, comb. inval. *Festuca fluitans* Leers ex Kunth, Enum. Pl. 1: 405. 1833, non L. 1753, pro syn. *Festuca loliacea* Hudson. *Lolium festucoides* Raspail ex Mutel, Fl. Franç. 4: 112. 1837, pro syn. *Festuca loliacea* Hudson. *Glyceria loliacea* (Hudson) Godron, Fl. Lorraine 3: 168. 1844. *Tragus loliaceus* (Hudson) Panzer ex B. D. Jackson, Index Kew. 2: 1099. 1895. ×*Festulolium loliaceum* (Hudson) P. V. Fournier, Quatre Fl. France: 81. 1935. TYPE: England. London: near Vauxhall, ad vias et in pascuis sed rarius.

The "intergeneric" hybrid ×*Festulolium loliaceum* is deemed a hybrid of congeneric taxa under the classification proposed here. The correct name under this scheme is *Lolium* ×*festucaceum* Link.

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Lagenocarpus venezuelensis, a New Name for *L. amazonicus* Davidse (Cyperaceae: Cryptangieae)

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ABSTRACT. *Lagenocarpus venezuelensis* Davidse is proposed as a new name for the later homonym *Lagenocarpus amazonicus* Davidse.

When I published the new species *Lagenocarpus amazonicus* based on two gatherings from Territorio Federal, Amazonas, Venezuela (Davidse, 1992), I overlooked the fact that this combination had already been used by Pfeiffer (1925) for the species now generally recognized (Koyama & Maguire, 1965: 53) as *Exochogyne amazonica* C. B. Clarke, Verh. Bot. Brandenburg 47: 101. 1906. Therefore, I propose the following new name for the illegitimate homonym:

Lagenocarpus venezuelensis Davidse, nom. nov. Replaced name: *L. amazonicus* Davidse, Novon 2: 319. 1992, non (C. B. Clarke) H. Pfeiffer, Repert. Spec. Nov. Regni Veg. 21: 35. 1925. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Río Negro, Cerro Aratitiyope, aprox. 70 km al SSW de Ocamo, 2°10′N, 65°34′W, con riachuelos afluente al río Manipitare, piedra ignea, 990—1,670 m, 24–28 Feb. 1984, *Steyermark, Berry & Delascio 130049* (holotype, MO; isotypes, NY, US, VEN).

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Dendrothrix, a New Generic Concept in Neotropical Euphorbiaceae

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ABSTRACT. The new genus *Dendrothrix* is proposed. Two of its species are new to science, the third one was originally allied to *Sapium*. Keys for distinguishing related genera using flowers, fruits, and leaves are provided, as is a key to the species of *Dendrothrix*.

A taxonomic revision of the subtribe Mabeinae Pax & K. Hoffmann of the Euphorbiaceae (tribe Hippomaneae A. Jussieu ex Spach) has necessitated the establishment of a new genus in order to accommodate species that have confused students of the Euphorbiaceae for some time. The three species are known from northern Brazil and Venezuela.

Dendrothrix Esser, gen. nov. TYPE: *Dendrothrix yutajensis* (Jablonski) Esser.

A ceteris generibus tribus Hippomanearum differt pilis ramosis, foliis integris subtus papillis obtectis sine glandulis marginalibus praeter bases glandulosas, thyrsis regulatim plerumque semel ramosis, glandulis bractearum disciformibus vel cyathiformibus, floribus masculinis bistaminalibus cum filamentis tota longitudine connatis, ovariis pubescentibus, et mericarpiorum septis filo vasculari furcato vel duplici instructis.

Trees or shrubs. Hairs multicellular and ramified. Leaves alternate, simple, coriaceous, entire; abaxial epidermis minutely but densely papillose; without petiolar, submarginal, or marginal glands but abaxially with a pair of basimarginal glands and sometimes with laminar glands of 0.2–0.35 mm diam.; petioles 1.5–5.5 cm long. Stipules very small to absent. Thyrses yellowish to cream-colored, terminal, always compound, mostly with one order of branching with several lateral thyrses, bracts small, scaly, glandless. Male cymules distal, at least 8-flowered, their bracts carrying basal glands which, when dry, are cup-shaped or disc-shaped and ± 1 mm long; bracteoles absent. Staminate flowers sessile, at anthesis with 0.6–1.0-mm-long pedicel, subtended by a two-parted calyx fused for most of its length; stamens two per flower, connate, lateral flowers often unistaminate; anthers 0.4 mm long, filaments at anthesis slightly longer than anthers. Female flowers proximal, bracteolate, shortly pedicellate, tricarpellate; sepals three, partly fused; ovary pubescent; style short but evident. Fruit a septicidal schizocarp, smooth, with scattered, caducous pubescence, glabrescent, up to 6 mm long. Mericarps bearing one bifurcate or two distinct vascular strands visible on each septum, leaving an inconspicuous alate central columella. Seeds dry, brown, smooth, carunculate in two species (not known in *D. multiglandulosa*).

The name of the genus refers to the treelike branched hairs, which are unusual for the Euphorbiaceae.

This genus differs from the other three neotropical genera of the Hippomaneae with compound thyrses in both its bistaminate male flowers and its totally fused filaments.

The inflorescence is similar to that of *Senefelderopsis* Steyermark: the thyrses are of the same size and are strictly terminal. A single, and rarely a second, order of branches occur, always subtended by small scaly bracts, and the staminate cymules are many-flowered. The two genera therefore can be confused superficially. However, the hairs of *Senefelderopsis* are multicellular but unbranched, the bracteal glands of its two species are always cylindrical when dry, the staminate flowers carry persistent bracteoles, and its fruits are larger (length 15–25 mm) and have a leathery outer layer. Additionally, the leaves of *Senefelderopsis* exhibit a row of abaxial submarginal glands and a pair of adaxial basal glands.

The hairs and fruits of *Dendrothrix* are very similar to those of *Mabea* Aublet. The leaf glands of *Mabea*, however, are strictly marginal or submarginal, never laminar. The lateral secondary thyrses of *Mabea* occur irregularly (they are missing in many species, whereas in others they can be several times compound), and the staminate cymules are mostly 3-flowered. The calyx of pistillate flowers and fruits consists of six sepals. *Mabea* always shows a single undivided vascular strand on each septum of the mericarps, the length of the capsules always exceeds 8 mm, and its indumentum is very dense and persistent.

Senefeldera C. Martius, the third other genus with compound thyrses, is quite different, e.g., it

has unbranched hairs, leaves without abaxial papillae and without basimarginal glands, bracteolate staminate cymules with 1–3 flowers each, mostly glabrous ovaries, and larger fruits.

The following keys should facilitate the distinction of the neotropical genera with compound thyrses:

KEY FOR CHARACTERS OF FRUITS

1a. Fruits, excluding style, up to 6 mm long .... *Dendrothrix*
1b. Fruits, excluding style, at least 7 mm long 2
  2a. Ripe fruits with fleshy outer layer that wrinkles when drying .... *Senefelderopsis*
  2b. Ripe fruits dry, not wrinkling 3
    3a. Fruiting calyx of 6 sepals; fruits with dense indumentum of shortly papillose or branched hairs .... *Mabea*
    3b. Fruiting calyx of 3 sepals; fruits glabrous or covered with long unbranched hairs .... *Senefeldera*

KEY FOR CHARACTERS OF STAMINATE FLOWERS

1a. Staminate cymules with many (≥ 6, often ≥ 10) flowers each 2
  2a. Glands of bracts of staminate cymules cylindrical; flowers with 3(–5) free stamens each .... *Senefelderopsis*
  2b. Glands of bracts of staminate cymules disc- or cup-shaped; flowers with 2 fused stamens each .... *Dendrothrix*
1b. Staminate cymules with 1–5(–7) flowers each 3
  3a. Staminate flowers at anthesis inclinate or nearly sessile .... *Senefeldera*
  3b. Staminate flowers at anthesis erect and clearly pedicellate .... *Mabea*

KEY FOR CHARACTERS OF LEAVES

1a. Leaves abaxially glaucous or papillose 2
  2a. Leaves with adaxial basal gland(s); abaxially one row of submarginal glands .... *Senefelderopsis*
  2b. Leaves without adaxial basal glands; abaxially with or without row of marginal or submarginal glands 3
    3a. Leaves always entire; abaxially papillose; never with abaxial row of marginal or submarginal glands, but mostly with laminar pellucid dots .... *Dendrothrix*
    3b. Leaves often serrate; if entire, abaxially never papillose; with or without row of marginal or submarginal glands, never with laminar pellucid dots .. *Mabea*
1b. Leaves abaxially shining and smooth, neither glaucous nor papillose 4
  4a. Petiole at least 2 cm long; leaf glands laminar .... *Senefeldera*
  4b. Petiole less than 2 cm long; leaf glands marginal, submarginal, or absent .... *Mabea*

Dendrothrix seems to be very closely related to *Senefelderopsis*. Both genera are centered in the Guayana Highland, although, interestingly, they occur only partially sympatric. *Senefelderopsis* is strictly endemic to the Guayana Highland and is widely distributed there, but is absent from its southern, e.g., Brazilian, part. *Dendrothrix*, on the other hand, has two species known only from the Venezuelan and Brazilian portion of the Guayana Highland and a third one occurring in Brazilian Amazonia near the northern margin of the Brazilian planalto. Furthermore, at least *Senefelderopsis chiribiquetensis* (R. Schultes & Croizat) Steyermark is very similar ecologically to the two Venezuelan species of *Dendrothrix*.

KEY TO THE SPECIES OF *DENDROTHRIX*

1a. Bracts of male flowers with at least two pairs of glands; mature leaves glabrous; tertiary leaf venation predominantly percurrent .... 1. *D. multiglandulosa*
1b. Bracts of male flowers with only one pair of glands; mature leaves pubescent; tertiary leaf venation clearly reticulate 2
  2a. Leaf blades elliptic; basal lateral nerves similar to distal ones; hairs reddish when dry .... 3. *D. yutajensis*
  2b. Leaf blades ovate; basal lateral nerves different from distal ones in length and angle of divergence; hairs pale when dry .... 2. *D. wurdackii*

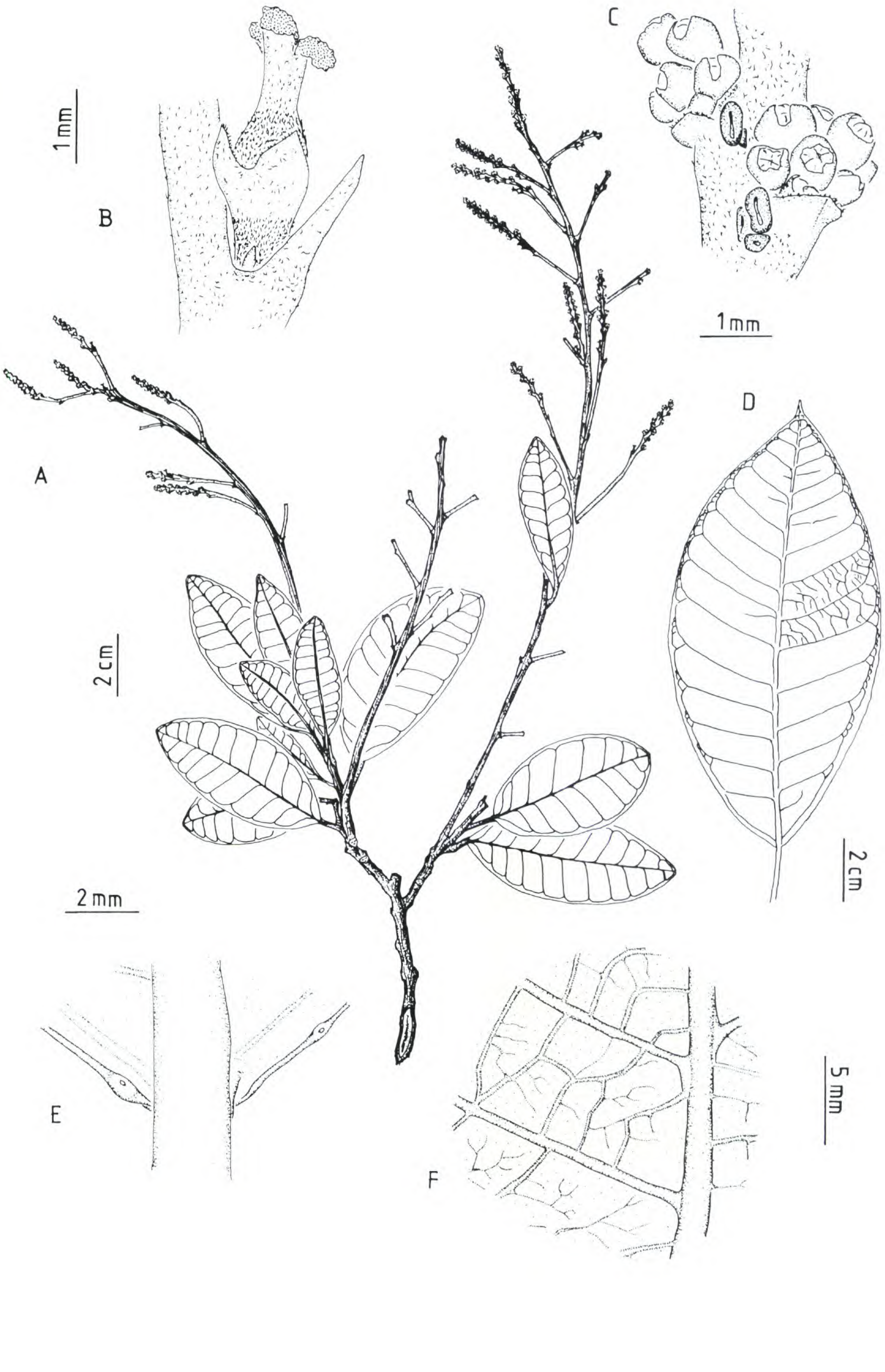
1. Dendrothrix multiglandulosa Esser, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Cerro Sipapo (Paráque), breaks below Lower Camp Savanna, alt. 4,400 ft., 15 Dec. 1948 (fl, fr), *B. Maguire & L. Politi 27683* (holotype, K; isotypes, GH, MICH, S, U, US). Figure 1.

Species generis *Dendrotrichis* pilis pallidis ornata, foliis mox glabrescentibus nervationem tertiariam percurrentem praebentibus, bracteis cymularum masculinarum minimum duobus paribus glandium instructis.

Shrub or tree, 4 m. Indumentum pale. Leaves elliptic to obovate, (10–)13–18 cm long, 5.0–9.5 cm wide, basally cuneate to obtuse, apically acute to obtuse; mature ones glabrous; secondary veins

→

Figure 1. *Dendrothrix multiglandulosa* Esser. —A. Habit. —B. Pistillate flower. —C. Portion of staminate part of inflorescence showing two cymules. —D. Old leaf. —E. Leaf base with glands, abaxial view. —F. Detail of percurrent leaf venation. (All drawn from *Maguire & Politi 27683.*)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11–14 pairs, tertiary venation percurrent; (0–)10–25 laminar glands on each half of blade, basal glands less than 1 mm long; petioles 2.0–5.5 cm long. Stipules unknown. Thyrses with flowering part up to 14 cm long, bracts of secondary branches 1.5 mm long. Each branch bearing 1 female flower and at least 10 male cymules. Bracts of male cymules with at least two pairs of glands. Bract of pistillate flower up to 2 mm long. Pedicel of pistillate flower 1 mm long; sepals (1.0–)1.5 mm long, 1.5–2.0 mm wide, mostly ciliate; style 1.0 mm long, stigmas 0.5–1.0 mm long. Fruits 4 mm long, mostly glabrous. Seeds unknown.

Distribution and phenology. Endemic to Cerro Sipapo, and locally frequent in low bush and mixed forest; flowering in December.

Jablonski (1967: 186) used both *Maguire & Politi 27683* and *Maguire & Politi 27885* to describe the pistillate flowers of *Senefelderopsis sipapoënsis* Jablonski. He did not recognize the profound differences from this genus that are discussed above. Both collections were distributed as *Senefelderopsis sipapoënsis* Jablonski.

Differential characters for *Dendrothrix multiglandulosa* beyond those given in the key are the higher number of leaf glands and the ciliate margins of the broad, apically rounded to acute sepals of the pistillate flowers. Stipules or abscission scars could not be found. It can be postulated that the stipules have been reduced totally, much more than in the other two species of the genus.

The name of the species refers to the multiple glands of the bracts of the staminate cymules.

Paratype. VENEZUELA. **Territorio Federal Amazonas:** Cerro Sipapo (Paráque), North Escarpment, alt. 1,400 m, 23 Dec. 1948 (fl), *B. Maguire & L. Politi 27885* (S).

2. Dendrothrix wurdackii Esser, sp. nov. TYPE: Brazil. Amazonas: Rio Aripuaña, Nova Prainha, Projeto RADAM/BRASIL SB-20-ZB Ponto 15, 15 July 1976 (fl, fr), *J. Ramos, J. Geraldo & L. Coêlho s.n.* (holotype, INPA-62163). Figure 2.

Species ejusdem generis pilis in sicco pallidis ornata, foliis ovatis subtus perduranter pubescentibus nervationem tertiariam reticulatam praebentibus, nervis secundariis basalibus dissimilibus isdem distalibus, parte connata stylorum perspicue breviore stigmatibus, bracteis cymularum masculinarum pari singulario glandium instructis.

Shrub, 1 m. Indumentum pale. Leaves ovate, up to 8 cm long, 4.5 cm wide, basally obtuse to rounded, apically acute; adaxially pubescent to glabrous, abaxially persistently pubescent; secondary veins 7–9 pairs, basal one differing from distal ones in length and angle of divergence, tertiary venation reticulate; 1–2 laminar glands on each half of blade, basally one large abaxial pair of glands (diameter 1 mm each); petioles 2–4 cm long. Stipules 0.5 mm long. Thyrses at least 6 cm long, bracts of secondary branches 1.5–2.5 mm long. Each branch bearing 1–2 female flowers and ± 25 male cymules. Bracts of male cymules with one pair of glands. Pistillate flower in the axil of a 2-mm-long bract. Pedicel 1 mm long; sepals 1.0–1.5 mm long, 1 mm wide, not ciliate, sometimes with glands; style 0.5–0.7 mm long, clearly shorter than stigmas. Fruits 6 mm long, sparsely pubescent. Seeds 4 mm long, 3 mm wide, with large caruncle.

Dendrothrix wurdackii is known only from the type collection, which was distributed as *Mabea* sp. More collections may exist, but have probably been distributed under different names.

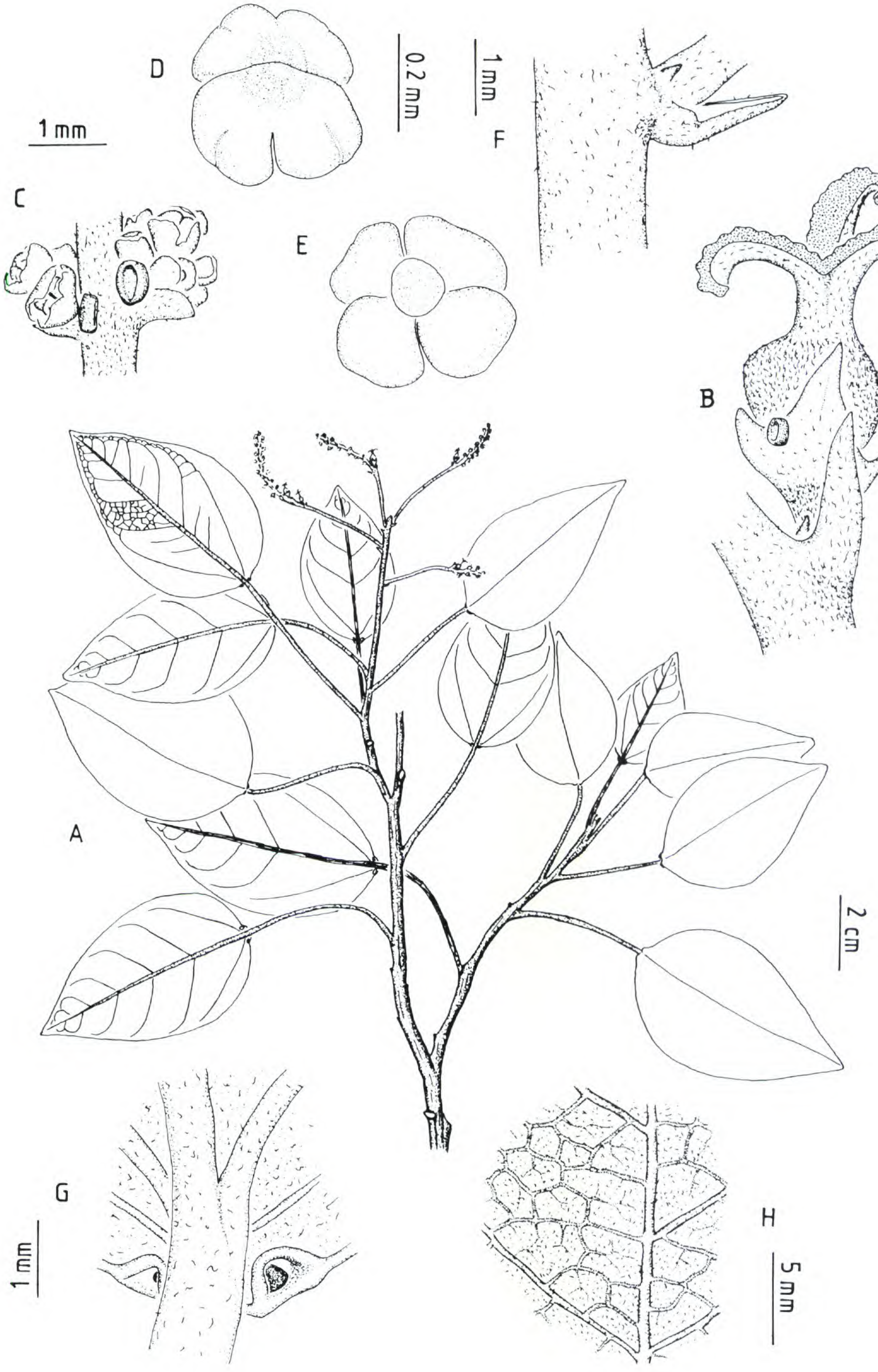
Ecological data of this species are not known. It differs from the other two species predominantly in characters of its leaves. Besides the characters listed in the key it is distinguished by the short styles and the large basal leaf glands, as well as the obtuse to rounded leaf base.

The name of the species honors Kenneth J. Wurdack, who, independently of me, recognized this new species as well as its affinities.

3. Dendrothrix yutajensis (Jablonski) Esser, comb. nov. Basionym: *Sapium yutajense* Jablonski, Mem. New York Bot. Gard. 17: 184. 1967, fig. 24. *Senefeldera yutajensis* (Jablonski) Webster, Ann. Missouri Bot. Gard. 76: 958. 1989. *Senefelderopsis yutajensis* (Jablonski) Mennega *in* Kruijt, Monographic Studies on *Sapium*. Doctoral Thesis, Rijksuniversiteit te Utrecht: 201. 1989. TYPE: Venezuela. Territorio Federal Amazonas: Caño Yutajé, 1,600 m, 15 Feb. 1953 (fl, fr), *B. & C. K. Maguire 35261* (holotype, NY). Figure 3.

→

Figure 2. *Dendrothrix wurdackii* Esser. —A. Habit. —B. Pistillate flower. —C. Portion of staminate part of inflorescence showing two cymules. —D. Androecium, dorsal view. —E. Androecium without filaments, ventral view. —F. Bract of secondary thyrse with bracteoles. —G. Leaf base showing glands, abaxial view. —H. Detail of reticulate leaf venation. (All drawn from *Ramos et al. s.n.*)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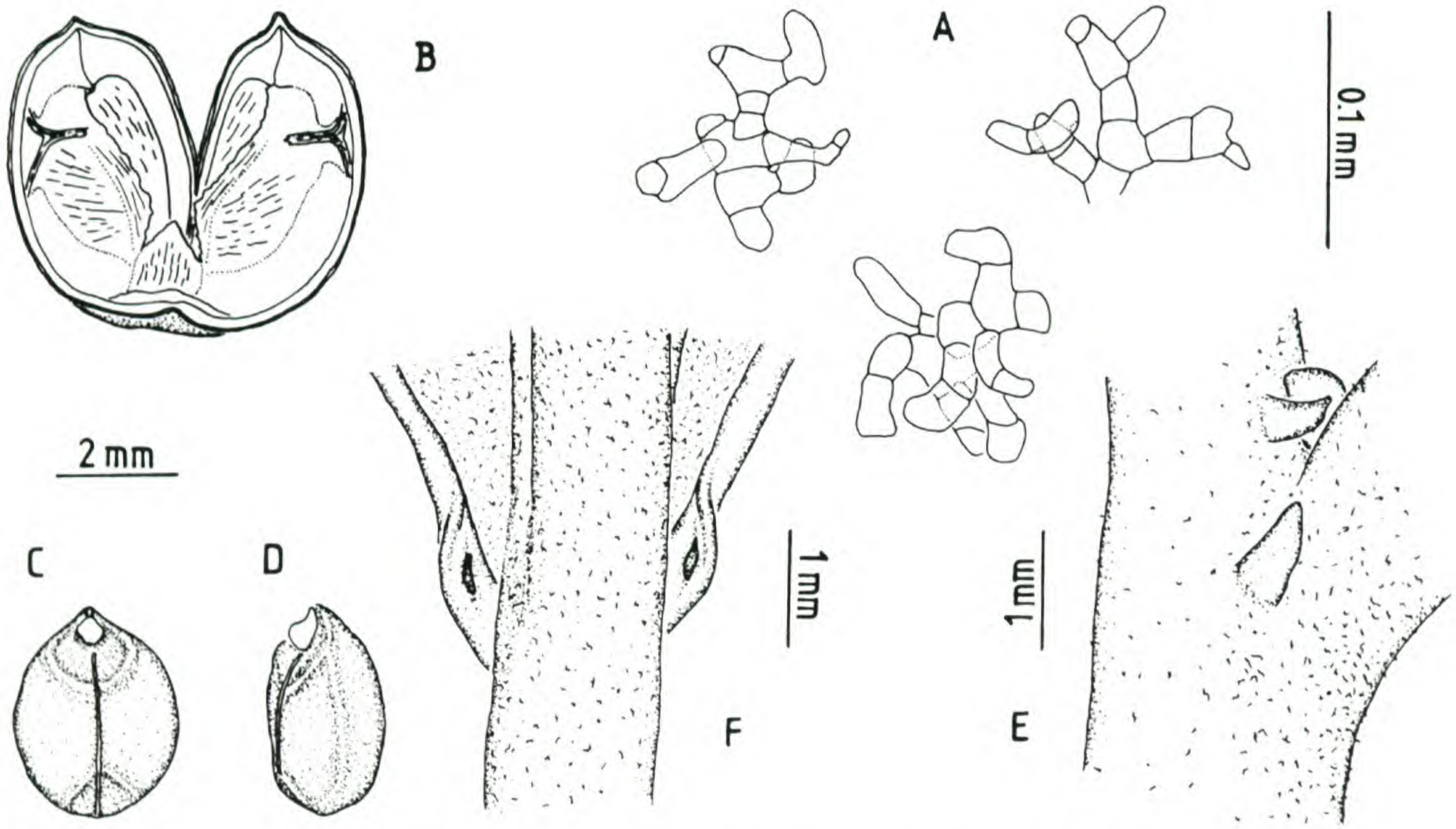

Figure 3. *Dendrothrix yutajensis* (Jablonski) Esser. —A. Hairs, upper view. —B. Mericarp, ventral view. —C. Seed, ventral view. —D. Seed, lateral view. —E. Detail of vegetative shoot showing stipule. —F. Leaf base showing glands, abaxial view. (A–D drawn from *Amaral 1523*; E, F drawn from *Rosa & Lira 2293*.)

Jablonski (1965: 176) had correctly cited the collection *Maguire et al. 30964* as *Senefelderopsis chiribiquetensis* (R. Schultes & Croizat) Steyermark. Two years later he erroneously made the same specimen one of the paratypes of his *Sapium yutajense*. Fortunately, his excellent drawings and the well-written description unequivocally refer to *Dendrothrix yutajensis*. The original description now has to be expanded:

Hairs always reddish. Leaves abaxially with 0–3 laminar and a pair of basimarginal glands (diameter less than 0.5 mm). Stipules persistent, squamiform, less than 1 mm long. Sepals of female flowers not ciliate. Style 1.5–2.0 mm long, exceeding length of stigmas. Seeds 3.5–4.0 mm long, 2.5 mm wide. Pollen grains 22 μm long, tectum perforate, exine psilate.

Distribution and phenology. Endemic to the Guayana Highland of Venezuela and Brazil, unknown from its western and eastern portion, and occasional to frequent in campos and thickets; flowering in November, January to March, May, fruits collected in February.

The most conspicuous difference between this species and the other two of the genus is the indumentum, which consists of reddish and quite firm hairs; within the Euphorbiaceae they are only comparable to those of *Mabea* Aublet.

Additional specimens examined. BRAZIL. **Amazonas:** Mun. Barcelos, Platô da Serra Aracá, parte SE da Serra Norte, alt. 1,150–1,250 m, 12 Feb. 1984 (fl, fr), *I. L. do Amaral 1523* (INPA, NY); plateau of northern massif of Serra Aracá, N part of Northern mountain near peak, alt. 1,400 m, 17 Feb. 1984 (fr), *G. T. Prance et al. 29140* (MG); Arredores do R. da Serra Aracá, 29 Jan. 1978 (imm. fr), *N. A. Rosa & S. B. Lira 2293* (MG). VENEZUELA. **Territorio Federal Amazonas:** Depto. Río Negro, Cerro de La Neblina Camp IV, 15 km NNE of Pico Phelps, alt. 780 m, 15–18 Mar. 1984 (fl), *R. Liesner 16685* (HBG); Serranía Yutaje, Río Manapiare, in right branch of Caño Yutaje, alt. 1,400 m, 9 Feb. 1953 (fl), *B. & C. K. Maguire 35103* (COL); Cerro de La Neblina, Río Yatua, banks of Cañon Grande E of Cumbre Camp, alt. 1,100 m, 24 Nov. 1957 (imm. fl), *B. Maguire et al. 42212* (U); Cerro Yapacana, en la cumbre, alt. 1,000–1,200 m, 5–7 May 1970 (fl), *J. A. Steyermark & G. S. Bunting 103143* (U). **Bolívar:** Distr. Heres, Cerro Marutani, piedra arenisca en la altiplanicie a lo largo del río Carla, alt. 1,200 m, 11–14 Jan. 1981 (imm. fr), *J. A. Steyermark et al. 123920* (NY).

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A New Species of *Streptostachys* (Poaceae: Paniceae) from Brazil

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ABSTRACT. A new species of *Streptostachys*, *S. rigidifolia*, from the Brazilian state of Maranhão is described, illustrated, and compared with previously described species in the genus. Anatomical data on the leaf blade of the new species are also provided.

Upon examination of recent gatherings of Poaceae from Maranhão, Brazil, a new species of *Streptostachys* P. Beauvois was encountered, which is here described, illustrated, and compared with species previously included in the genus by Morrone & Zuloaga (1991).

Streptostachys rigidifolia Filgueiras, Morrone & Zuloaga, sp. nov. TYPE: Brazil. Maranhão: Loreto, BR-230, estrada para São Raimundo das Mangabeiras, ca. 22 km de São Raimundo, 6°56′S, 45°19′W, cerrado baixo com estrato graminoso aberto, 13 maio 1988, *L. B. Bianchetti, F. R. Ferreira & J. N. Silveira 634* (holotype, CEN; isotypes, B, BM, IBGE, K, MO, R, RB, SI, SP, UB, US). Figures 1–3.

Ab omnibus speciebus generis flosculo superiore glabro papillis compositis ornato differt. *Streptostachys ramosa* similis sed plantis 68–95 cm altis, inflorescentia racemosa vel subpaniculata 6–17 cm longa abunde differt.

Robust, stout, caespitose and short-rhizomatous perennial. *Culms* 68–95 cm tall, simple, bearing basal and cauline leaves; internodes cylindrical, hollow, glabrous; nodes swollen, shortly pilose with whitish hairs. *Sheaths* pilose, more so toward the base, or glabrous, striate, one margin hyaline, the other ciliate. *Ligules* a ciliate rim ca. 1 mm long, with hairs up to 7 mm long, behind the ligule at the base of the blade and on the upper margins of the sheaths. *Blades* lanceolate, 25–50 cm long, 5–8 mm wide, rigid, glabrous or with few scattered hairs, strongly striate, rounded at the base, the apex pungent, acuminate, the margins denticulate and/or ciliate. Peduncle cylindrical, scabrous, to 30 cm long. *Inflorescence* exserted, racemose or subpaniculate, 6–17 cm long, formed by 2–6 branches 9–11 cm long, all bearing unilateral spikelets along their entire length; main axis short, triquetrous, scabrous, terminating in a spikelet; spikelets solitary on the branches, the pedicels 1–3 mm long, swollen, partially adnate to the rachis of the branches. *Spikelets* narrowly ellipsoid, 5–8 mm long, shortly pilose, with thickened, conspicuous internodes between the glumes, and florets; upper glume and lower lemma subequal, conspicuously coriaceous. *Lower glume* ovate, 3–6 mm long, ⅓–⅔ the length of the spikelet, acute, 3(–5)-nerved, adaxial, slightly asymmetrical. *Upper glume* 5–6 mm long with a few short hairs throughout, 5-nerved, the nerves anastomosed toward the apex. *Lower floret* male; stamens 3, the anthers 3 mm long; lodicules 2, truncate, conduplicate, 0.5–0.8 mm long; lower lemma 5.5–6.5 mm long, 5-nerved, prominently pilose toward the apex; lower palea well developed, lanceolate, 4.2 mm long, 1.6 mm wide, hyaline, strongly 2-nerved. *Upper floret* narrowly ovoid, 4.5 mm long, 1.6 mm wide, indurate, pale, shiny, with regular compound papillae evenly distributed over the surface of the lemma and palea; lemma 5-nerved; styles 2, free from the base of the gynoecium; stigmas plumose, purple; stamens 3, with purple anthers; lodicules 2, conduplicate, 0.5–0.8 mm long. *Caryopsis* planoconvex, 3–3.5 mm long; hilum linear along the entire length of the caryopsis.

Streptostachys rigidifolia is known only from a single population in the municipality of Loreto, Maranhão, Brazil, in cerrado vegetation.

This species has been included in *Streptostachys* because of its inflorescence type, the thickening of the rachilla between the glumes and florets, the nervation of the glumes and lower lemma, and the linear hilum (Morrone & Zuloaga, 1991).

Streptostachys rigidifolia is unique in the genus because of its glabrous upper floret, with compound papillae over its entire surface. It can be further distinguished from *S. ramosa* and *S. macrantha* by the coriaceous upper glume and lower lemma; in *S. ramosa* and *S. macrantha* the upper glume and lower lemma are membranous; both species have a pilose upper floret with simple papillae over the

Figure 1. *Streptostachys rigidifolia* Filgueiras, Morrone & Zuloaga. —a. Habit. —b. Schematic longitudinal section of spikelet base, indicating conspicuous thickened internodes: Lg: lower glume; Ug: upper glume; Ll: lower lemma; Lp: lower palea; Ul: upper lemma; Up: upper palea; Lo: lodicules; Gy: gynoecium. —c. Spikelet, ventral view. —d. Spikelet, lateral view. —e. Spikelet, dorsal view. —f. Upper palea and lodicules. —g. Upper floret, dorsal view. —h. Upper floret, ventral view, lemma and palea. (Based on *Bianchetti et al. 634.*)

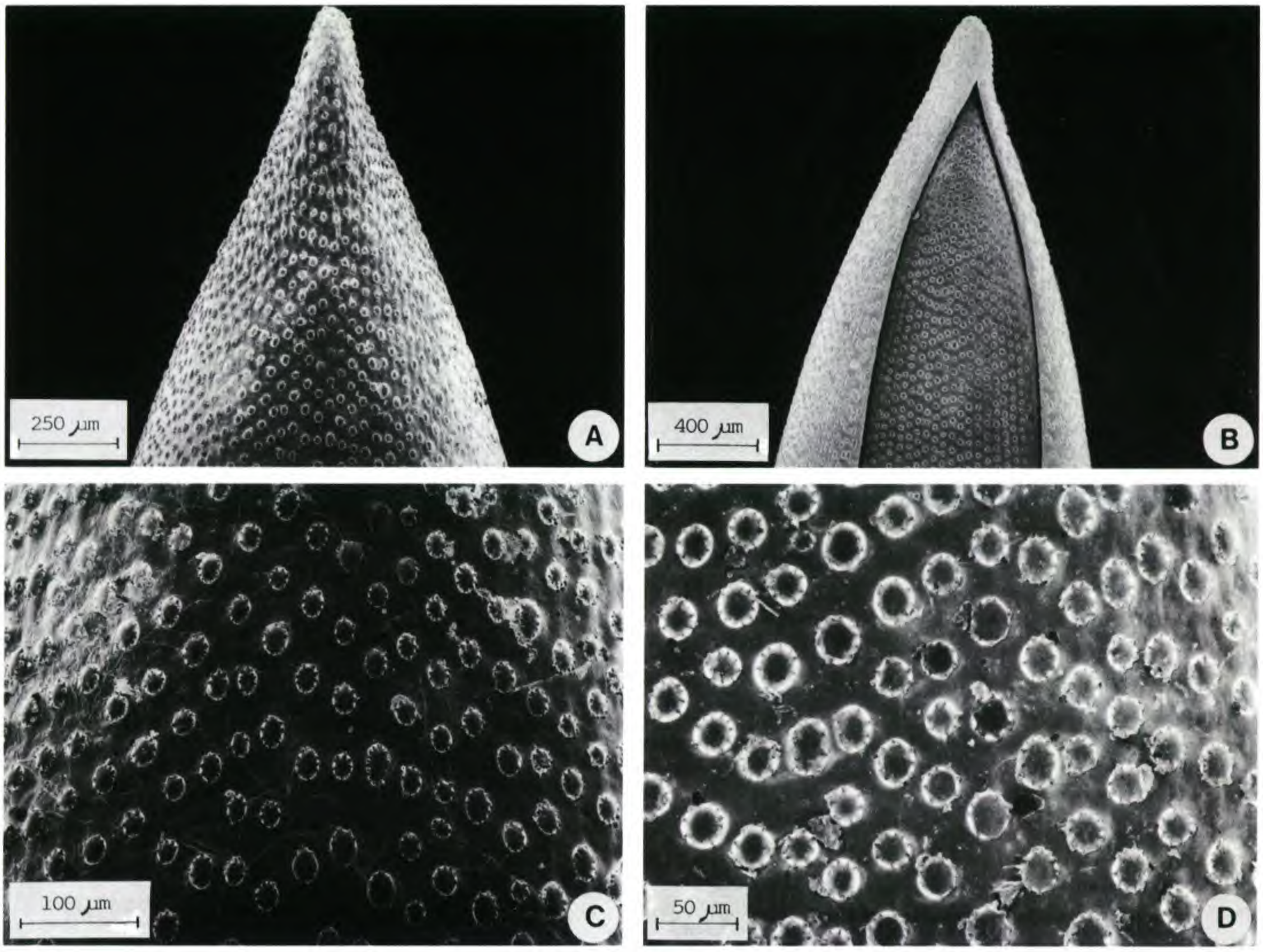

Figure 2. Scanning electron micrographs of the upper floret of *Streptostachys rigidifolia.* —A. Upper portion of lemma. —B. Upper portion of palea and lemma. —C. Detail of the surface of the upper lemma showing compound papillae. —D. Detail of the surface of the upper palea showing compound papillae. (Based on *Bianchetti et al. 634.*)

surface of lemma and palea. The plant height and inflorescence size and shape are further distinguishing characters: *S. macrantha* includes plants 30–70 cm tall, and inflorescences with whorled lower branches. *Streptostachys ramosa* includes plants 130–200 cm tall, inflorescences 30–45 cm long, with whorled lower branches. *Streptostachys asperifolia* differs from *S. rigidifolia* by the following features: presence of axillary inflorescences, spikelets 3.6–5.1 mm long, lower glume $\frac{2}{3}$–$\frac{4}{5}$ the length of the spikelet, absence of lower flower and blades cordate, amplexicaulous.

Paratypes. BRAZIL. **Maranhão:** Loreto, km 291.2 da BR-230, barranco íngreme de estrada a cerca de 22 km de São Raimundo, 20 março 1983, *J. F. M. Valls, G. Veiga & Silva 8432* (CEN, ICN, MEXU, VEN).

ANATOMY OF *STREPTOSTACHYS RIGIDIFOLIA*, FIGURE 3

The techniques used in the anatomical study follow Morrone & Zuloaga (1991), and the terminology follows Ellis (1976, 1979).

LEAF BLADE IN TRANSVERSE SECTION, FIGURE 3A, B

Outline: open, expanded, flat, two halves symmetrical on either side of median vascular bundle; leaf thickness 310–420 µm. *Ribs and furrows:* rounded adaxial ribs, associated with first- and second-order vascular bundles; the larger ribs alternated with the smaller ones; adjacent ribs separated by narrow furrows, penetrating up to $\frac{1}{3}$ the leaf thickness; abaxial ribs and furrows slightly undulating with no regular pattern associated with the vascular bundle. *Median vascular bundle:* midrib or keel not developed; median vascular bundle structurally indistinguishable from lateral first-order vascular bundles. *Vascular bundle arrangement:* 15 first-order vascular bundles, 10 second-order vascular bundles and 34–36 third-order vascular bundles in entire blade; 1 second-order vascular bundle and 2–3 third-order vascular bundles between consecutive first-order vascular bundles. First-order vascular bundles centrally located in the blade thickness, second- and third-order vascular bundles abaxially displaced. *Vascular bundle description:* first-

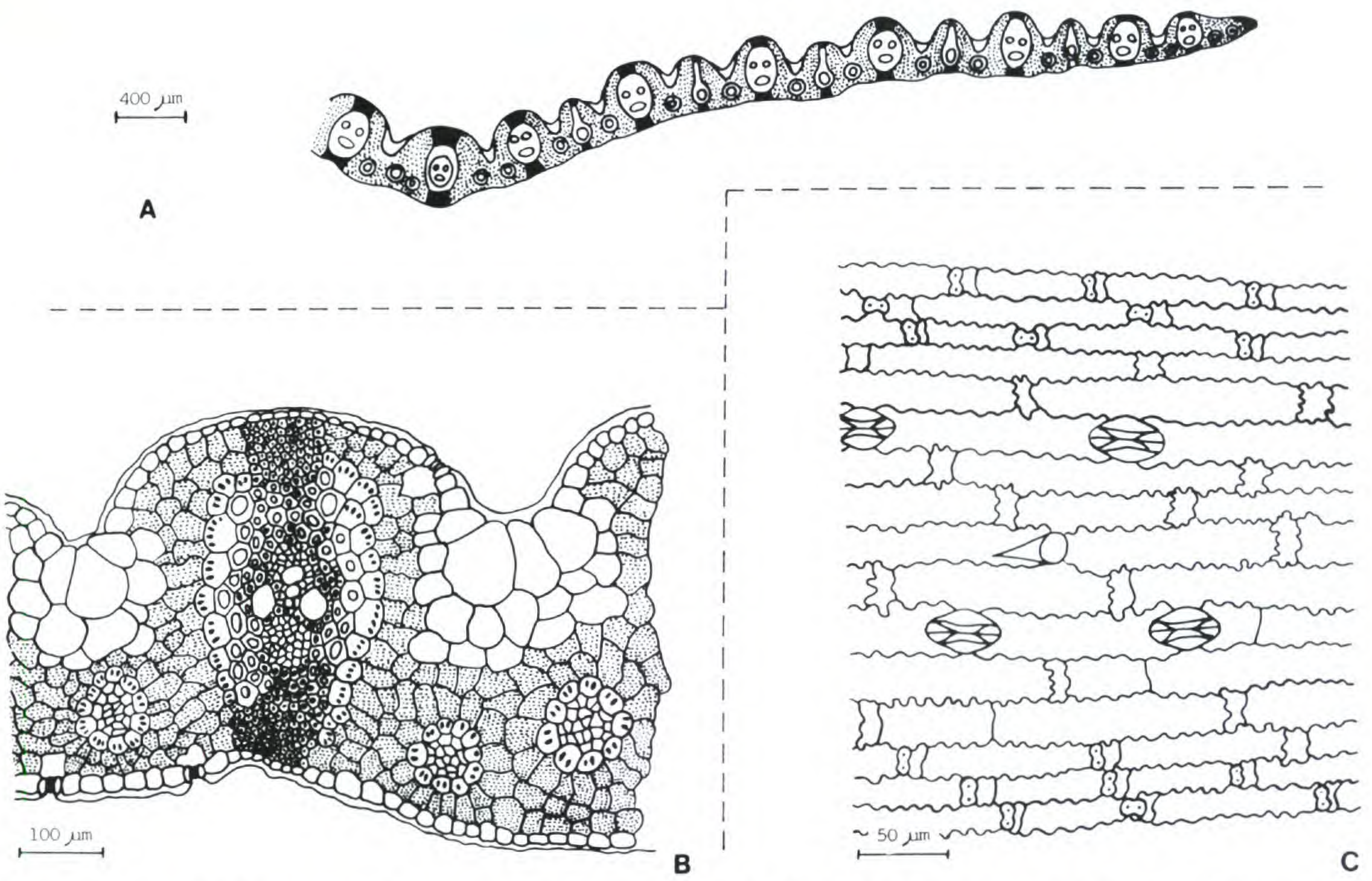

Figure 3. Leaf blade anatomy of *Streptostachys rigidifolia*. —A. Outline showing absence of a keel. —B. Transverse section detail showing first-, second-, and third-order vascular bundles, bulliform cells with associated colorless cells. —C. Abaxial epidermis showing costal and intercostal zones. (Based on *Bianchetti et al. 634.*)

order vascular bundle elliptical in outline; metaxylem vessel equal or bigger than the Kranz cells as seen in section, metaxylem vessels slightly angular in outline; sclerenchymatous cells present in 1–3 rows between the metaxylem vessels and Kranz cells, fibers lignified, lumen small; phloem tissue completely surrounded by thick-walled fibers. Second-order vascular bundle elliptical in outline with xylem and phloem tissue distinguishable. Third-order vascular bundle angular in outline with metaxylem and phloem tissue indistinguishable, located below the furrows. *Vascular bundle sheaths:* first-order vascular bundle surrounded by a single Kranz mestome sheath of 22–27 cells, with adaxial and abaxial interruption of sclerenchyma girders; second-order vascular bundles completely surrounded by a single Kranz mestome sheath, consisting of 12–14 cells; adaxial extensions 1–3-seriate, 2–5 cells deep. Kranz mestome sheath of third-order vascular bundles entire, with 7–10 cells. Kranz cells rounded, with radial and outer tangential wall inflated, longer parallel to the vein in paradermal section; specialized chloroplasts with tendency to show a centrifugal location. *Sclerenchyma:* adaxial and abaxial girders well developed, relatively narrow and deep, always associated with all first-order vascular bundles; sclerenchyma minute, inconspicuous adaxial and abaxial girders associated with all second-order vascular bundles; girders or strand not associated with third-order vascular bundles. Fibers very thick-walled with lumens almost completely filled, lignified. Small sclerenchyma cap in the leaf margin, curved in shape with sclerenchyma extending along abaxial side of the leaf. *Mesophyll:* chlorenchyma irregularly radiate, continuous between vascular bundles, cells small, irregularly shaped, tightly packed without visible intercellular air spaces; 2–3 chlorenchyma cells between contiguous vascular bundles, 95–200 µm between contiguous vascular bundles; colorless cells below the bulliform cells. Fusoid cells absent. Arm cells absent. *Adaxial epidermal cells:* bulliform cells present at the base of all adaxial furrows and occurring in restricted, fan-shaped groups usually with an inflated central cell; bulliform cells up to ⅓ the leaf thickness. Epidermal cells with distinct continuous cuticle; prickle hairs present; macrohairs, microhairs, and papillae absent. *Abaxial epidermal cells:* bullifom cells absent; epidermal cells small with a very thick cuticle; prickle hairs present; macrohairs, microhairs, and papillae absent. *Amiloplast* present in the Kranz cells.

ABAXIAL EPIDERMIS IN SURFACE VIEW, FIGURE 3C

Costal zone: long cells rectangular in outline, more than 3× longer than wide, anticlinal walls

parallel, undulated; long cells separated by cork-silica cell pairs; silica bodies irregularly dumbbell-shaped. Prickles absent. *Intercostal zone:* long cells rectangular in outline, more than 3× longer than wide, anticlinal walls parallel, end walls vertical; long cells separated by single short cells; silica bodies irregular in outline. *Microhairs:* absent. *Stomatal complex:* low triangular, 38–45 μm long, 23–28 μm wide, in 2 rows in the costal zone; one intersto-matal cell between successive stomata in a row. *Macrohairs:* present or absent, when present in the leaf margin, cushion base. *Hooks:* present in the middle of the intercostal zone, small with the base shorter than the stomata, barb shorter than the base. *Papillae:* absent.

ADAXIAL EPIDERMIS IN SURFACE VIEW

Costal zone: same as for the abaxial surface, but with conspicuous prickles. *Intercostal zone:* long and short cells identical to those of the abaxial epidermis. *Microhairs:* none seen. *Stomatal complex:* low triangular, arrangement as in the abaxial epidermis. *Macrohairs:* same as for the abaxial epidermis. *Hooks:* frequently in the intercostal zone, small with the base shorter than the stomata; barb developed basally from the apex to the base, longer than the base. *Papillae:* absent.

The epidermal characters of *S. rigidifolia* correspond to the panicoid dermotype (Prat, 1960), with irregular dumbbell-shaped silica bodies, rectangular long-cells with undulating walls and alternating with short cells. An interesting feature that became evident in this study was the absence of bicellular microhairs on both epidermides of *S. rigidifolia*. This is noteworthy since bicellular microhairs are characteristic of subfamily Panicoideae (Ellis, 1977), and they are also present in all the other species of *Streptostachys*. It should, however, be noted that they are also lacking in other panicoid genera such as *Yvesia*, *Oryzidium*, and *Milbraedochloa* (Renvoize, 1987).

Streptostachys rigidifolia is, according to the anatomical data presented here, a Kranz species, of the subtype MS, with a single Kranz mestome sheath around the vascular bundles, with centrifugal chloroplasts on the Kranz sheath, cells of the mestome sheath longitudinally elongated in paradermal view, and 2–3 mesophyll cells between contiguous vascular bundles.

According to the correlation encountered in the Kranz syndrome between anatomical and physiological characters (Brown, 1977; Ellis, 1977; Hattersley, 1987; Tregunna et al., 1970), it is concluded that *S. rigidifolia* is a C_4 species of the NADP-me physiological subtype or malate former (Downton, 1970; Gutiérrez et al., 1974).

Streptostachys rigidifolia shares with *S. ramosa* and *S. macrantha* a similar anatomical type, being all C_4, MS species without fusoid cells. *Streptostachys ramosa*, however, has bicellular microhairs, conspicuous papillae on the abaxial epidermis, discoid stomata, four types of vascular bundles, and no colorless cells below the bulliform cells. *Streptostachys macrantha* also has bicellular microhairs, a thinner transverse section and four types of vascular bundles. *Streptostachys asperifolia* differs by being a C_3 species with keel, arm cells, and conspicuous fusoid cells (full anatomical descriptions of the species previously mentioned are given in Morrone & Zuloaga, 1991).

Acknowledgments. We are grateful to Luciano de Bem Bianchetti and J. F. M. Valls for the loan of specimens from CEN and to Vladimiro Dudás for the preparation of the drawings in Figure 1. Filgueiras thanks CNPq and CAPES for the partial financial support for this study. He is especially grateful to the Missouri Botanical Garden for a grant (May Scholar 1991) that enabled him to spend three months working in the herbarium at the Garden.

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A New Species of *Euphorbia* (Euphorbiaceae) from Masirah Island, Sultanate of Oman

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ABSTRACT. *Euphorbia masirahensis*, a new species from Masirah Island, Sultanate of Oman, is described. Its habitat and flowering and fruiting periods are given, and its distribution and endemicity are discussed. An illustration of the species and a distribution map are also provided.

Euphorbia masirahensis S. A. Ghazanfar, sp. nov. TYPE: Sultanate of Oman, NE Masirah Island, Wadi Zamji, FH 690960, 80 m, on stony slope of wadi, 27 Nov. 1991, *S. A. Ghazanfar 1515* (holotype, BSB; isotypes, E, K, ON, Herbarium Sultan Qaboos University—SQUH[1]). Figure 1.

Euphorbiae schimperi Presl primo adspectu maxime similis, sed cyathiis sessilibus, solitariis, terminalibus vel ramis lateralibus distincta. Rami ascendentes. Semina fulva, glabra, laevigata.

Perennial shrub, leafless, forming large clumps up to 70 cm tall and 150 cm wide. Branches glabrous, bluish green, arising from a thick tap root. Branches and branchlets ascending. New branchlets red. Leaves readily deciduous, alternate, 1–1.5 × 1 mm, ovate, sessile, glabrous, reddish green. Cyathia solitary, terminal on the main branch or on lateral branchlets, sessile, subtended by two ovate bracts; bracts ca. 2 × 1.5 mm, glabrous. Cyathial involucre 4.5–5 mm (including the glands) and 6–6.5 mm across. Cyathial glands 5, ca. 3 × 1–1.5 mm, patent, transversely oblong, ochraceus. Marginal lobes alternating with the cyathial glands. Male flowers numerous, each consisting of a single stamen; pedicel ca. 1.5 mm long, whitish yellow; anthers 0.75–1 mm long, yellow. Bracts ca. 1 mm, glabrous, deeply dentate at the apex. Female flower consisting of a single ovary, sessile. Ovary glabrous, trilocular; styles 3, united to about two-thirds their length from the base; stigmas bifid. Fruit schizocarpic, 5–6 mm long and 5–5.5 mm across, 3-valved, green suffused with red when young, dark brown when mature; fruit not reflexed at maturity. Dehiscence septicidal, splitting into 3 bi-valved cocci. Seed one in each locule, 2.5–3 × ca. 2 mm, oblong, glabrous, smooth, yellow-brown with a whitish longitudinal stripe and a white caruncle.

Habitat and flowering. The species occurs on stony, gravel, and rocky slopes of wadis and the lower slopes of Jabal Dawwah, Masirah Island, from 70 to 80 m. Flowering and fruiting from November to early January, but also more or less throughout the year.

Distribution. Endemic to Masirah Island.

Paratypes. SULTANATE OF OMAN. **Masirah Island:** Wadi Zamji (Palm wadi), FH 690960, 80 m, *S. A. Ghazanfar 1374* (SQUH); Wadi Zamji, stony slope, *D. Rappenhöner OM91-54* (ON, BSB); Jabal Humr, Palm Wadi, 25 Feb. 1992, *J. Bryan s.n.* (SQUH, in spirit).

KEY TO THE UNARMED, APHYLLOUS, SUCCULENT SPECIES OF *EUPHORBIA* IN OMAN

1a. Cyathium solitary, sessile; capsule up to 5.5 mm diam., dark brown at maturity (red when young); stems bluish green ..... *E. masirahensis* S. A. Ghazanfar
1b. Cyathia clustered in groups of 4–6, the central cyathium sessile, the lateral cyathia pedunculate; capsule more than 5.5 mm diam., red or buff at maturity; stems pale green 2
2a. Capsule ca. 10 mm diam., pale brown at maturity with purple-red lines along the sutures ..... *E. larica* Boissier
2b. Capsule ca. 7 mm diam., red at maturity 3
3a. Cyathial glands yellow; seeds black, smooth ..... *E. schimperi* Presl
3b. Cyathial glands red or reddish green; seeds reddish brown, rugose ..... *E. dhofarensis* S. Carter

The new species is named after Masirah Island, where it is endemic. In Masirah it has a restricted distribution, occurring only in the northern part of the central mountains (Fig. 2). It is common on the lower slopes of these mountains and on the stony slopes of the wadis. Though restricted to a single locality in Masirah, *E. masirahensis* is well estab-

[1]Acronym officially approved for Department of Biology, Sultan Qaboos University, P.O. Box 36, Al-khod 123, Muscat, Sultanate of Oman, and for publication in the next edition of *Index Herbariorum*.

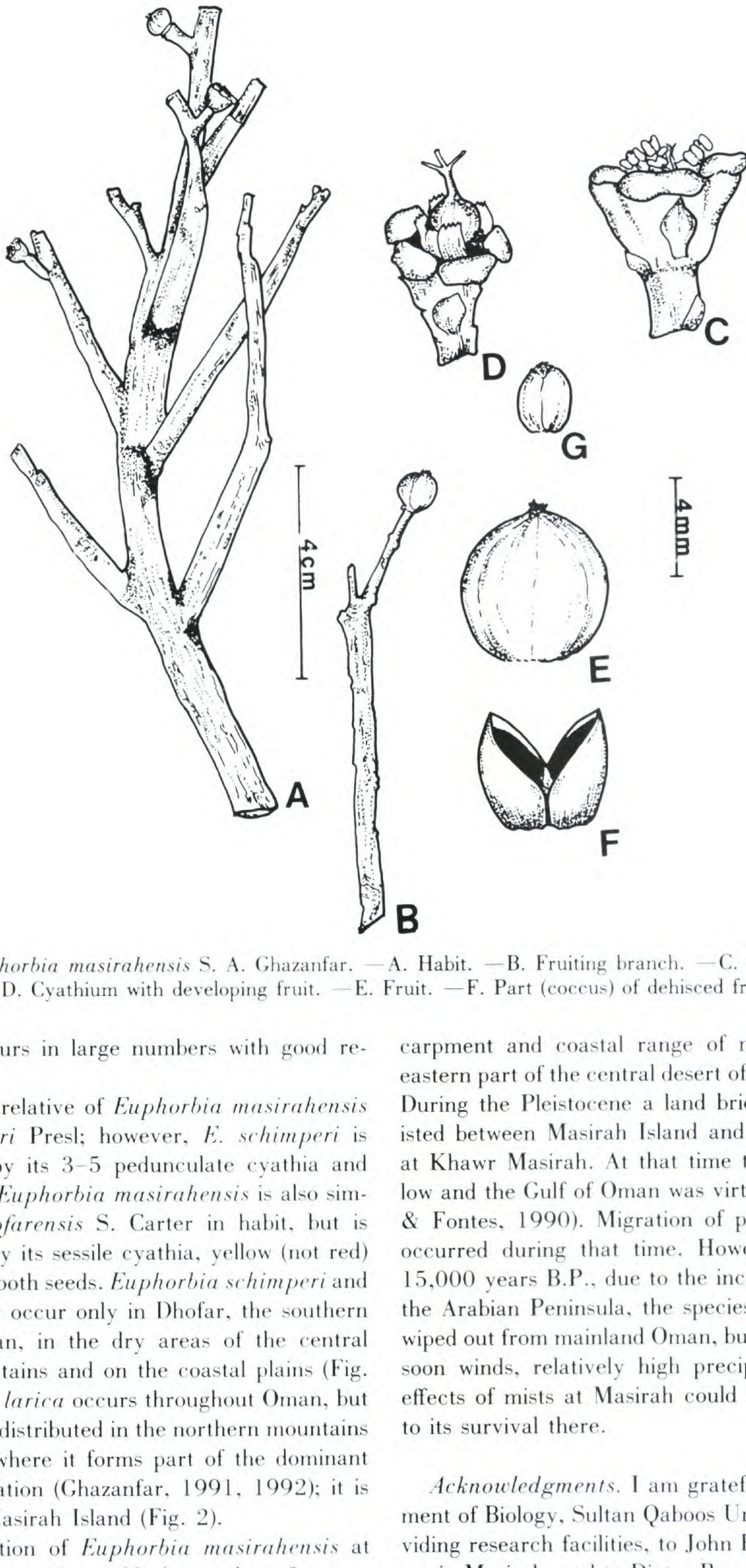

Figure 1. *Euphorbia masirahensis* S. A. Ghazanfar. —A. Habit. —B. Fruiting branch. —C. Cyathium showing male flowers. —D. Cyathium with developing fruit. —E. Fruit. —F. Part (coccus) of dehisced fruit. —G. Seed.

lished and occurs in large numbers with good regeneration.

The closest relative of *Euphorbia masirahensis* is *E. schimperi* Presl; however, *E. schimperi* is distinguished by its 3–5 pedunculate cyathia and stalked fruits. *Euphorbia masirahensis* is also similar to *E. dhofarensis* S. Carter in habit, but is distinguished by its sessile cyathia, yellow (not red) glands, and smooth seeds. *Euphorbia schimperi* and *E. dhofarensis* occur only in Dhofar, the southern region of Oman, in the dry areas of the central range of mountains and on the coastal plains (Fig. 2). *Euphorbia larica* occurs throughout Oman, but is more widely distributed in the northern mountains and foothills, where it forms part of the dominant shrubby vegetation (Ghazanfar, 1991, 1992); it is absent from Masirah Island (Fig. 2).

The population of *Euphorbia masirahensis* at Masirah Island could possibly be a relict of a once luxuriant population that also occurred on the escarpment and coastal range of mountains in the eastern part of the central desert of mainland Oman. During the Pleistocene a land bridge probably existed between Masirah Island and mainland Oman at Khawr Masirah. At that time the sea level was low and the Gulf of Oman was virtually dry (Clarke & Fontes, 1990). Migration of plants could have occurred during that time. However, in the last 15,000 years B.P., due to the increasing aridity of the Arabian Peninsula, the species may have been wiped out from mainland Oman, but the humid monsoon winds, relatively high precipitation, and the effects of mists at Masirah could have contributed to its survival there.

Acknowledgments. I am grateful to the Department of Biology, Sultan Qaboos University, for providing research facilities, to John Bryan for guiding me in Masirah, and to Dieter Rappenhöner for critically reading the manuscript. John Turvey checked

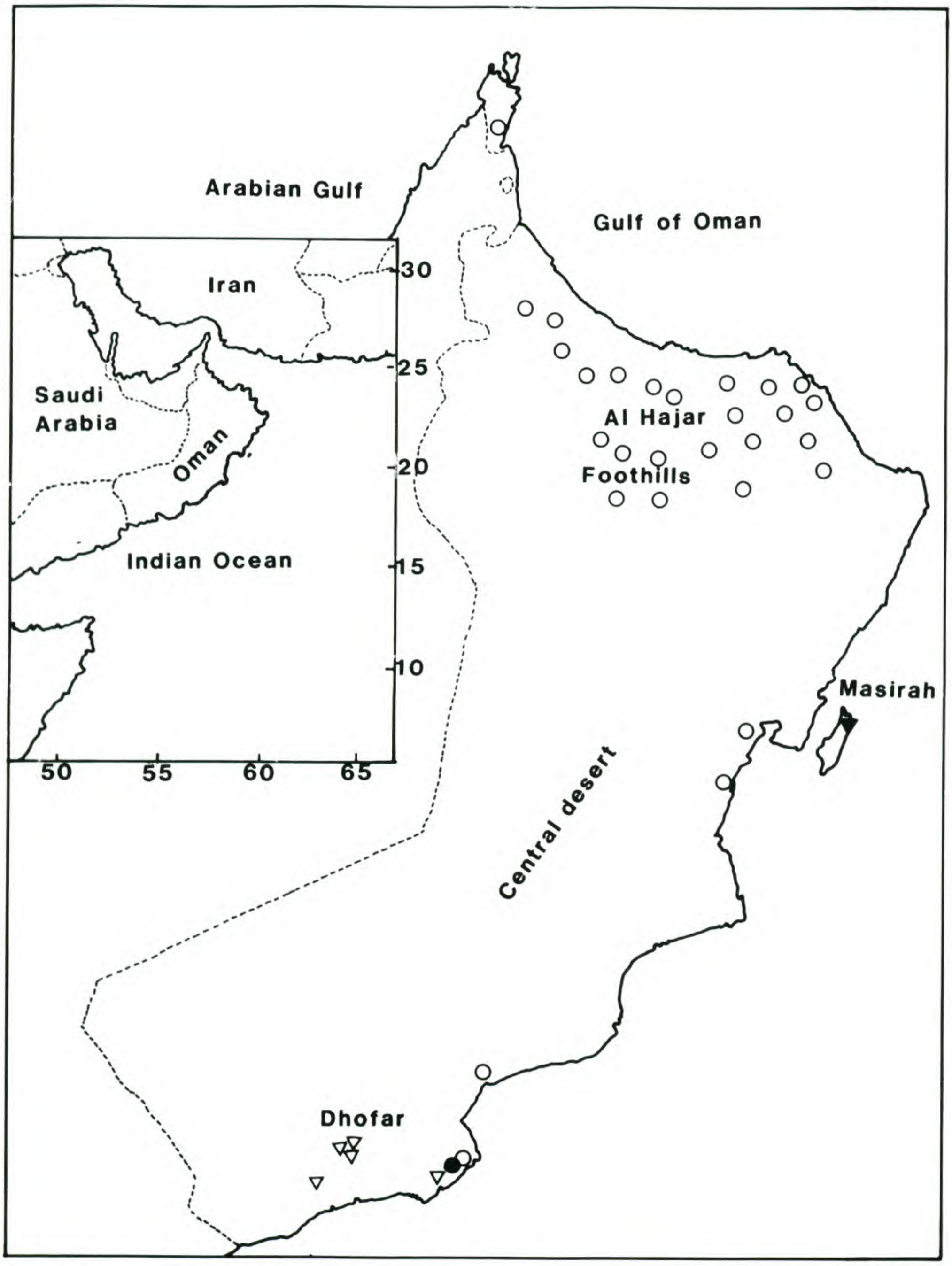

Figure 2. Distribution of *Euphorbia dhofarensis* (▽), *E. larica* (○), *E. masirahensis* (▼), and *E. schimperi* (●) in Oman.

the Latin diagnosis and Fatima Farooq cultivated the species successfully at the Sultan Qaboos University Botanic Garden.

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Nomenclatural Adjustments in Chinese Plumbaginaceae

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ABSTRACT. Four new combinations in *Limonium* (*L. lacostei*, *L. dielsianum*, *L. chrysocomum* subsp. *semenovii*, and *L. callianthum*), one in *Armeria* (*A. labradorica* subsp. *sibirica*), and one in *Acantholimon* (*A. laevigatum*) are proposed.

During the revision of Plumbaginaceae for the *Flora of China*, it became evident that the nomenclature of six poorly understood taxa in the genera *Acantholimon*, *Limonium*, and *Armeria* required some adjustment. In order to make the names available for the forthcoming volume of the *Flora of China*, the nomenclatural changes are herein proposed.

Acantholimon laevigatum (Peng) R. Kamelin, comb. et stat. nov. Basionym: *Acantholimon alatavicum* Bunge var. *laevigatum* Peng, Guihaia 3: 291. 1983. TYPE: China. Xinjiang: Wenquun, *K. C. Kuan 1564* (holotype, PE).

The differences in leaf color, size, and flattening, size of outer and inner bracts, and size and indumentum of calyx support the recognition of *Acantholimon laevigatum* and *A. alatavicum* as distinct species instead of varieties of the latter.

Armeria labradorica Wallroth subsp. **sibirica** (Turczaninow) R. Kamelin, comb. et stat. nov. Basionym: *Armeria sibirica* Turczaninow in Boissier, A. de Candolle, Prodr. 12: 678. 1848. TYPE: [Russia]. Siberia: Ad Tessinsky dozor, ? *J. Kusnetov s.n.* (holotype, LE).

This taxon is widespread in bogs and meadows on alpine slopes or high plateaus at 3,000–3,500 m in the Altai Mountains in Mongolia and South Siberia, Russia. It is highly likely that the species also occurs in China, because it has been collected from several stations along the Mongolian–Chinese border in the Altai Mountains.

Limonium lacostei (Danguy) R. Kamelin, comb. nov. Basionym: *Statice lacostei* Danguy, J. Bot. (Paris) sér. 2, 1(3): 53. 1908. TYPE: [China. Xinjiang]: Vallée de Tegermanlik, 4,000 m, 26 Aug. 1906, *La Coste s.n.* (holotype, P). *Limonium roborowskii* Ikonnikov-Galitzky, Acta Inst. Bot. Acad. Sci. URSS, ser. 1, 2: 255. 1936, syn. nov. TYPE: China. Xinjiang: Kashgaria, Kara-teke, 9 June 1889, *W. J. Roborowsky s.n.* (lectotype, LE).

Peng (1987) cited *Statice lacostei* as a synonym of *Limonium aureum* (L.) Hill and maintained *L. roborowskii* as a distinct but related species. *Statice lacostei* and *L. roborowskii* are conspecific, and the correct name for the species is *L. lacostei*. The latter is readily distinguished from *L. aureum* by its straight, nonflexuous rachis and light or lemon-yellow calyx limb, instead of dichotomously branched, strongly flexuous rachis and golden calyx limb.

Limonium dielsianum (Wangerin) R. Kamelin, comb. nov. Basionym: *Statice dielsiana* Wangerin, Repert. Spec. Nov. Regni Veg. 17: 399. 1921. *L. aureum* (L.) Hill var. *dielsianum* (Wangerin) Peng, Fl. Reipubl. Popul. Sin. 60(1): 38. 1987. TYPE: China. [Qinghai] (as Tibet): beim Lager 66 am Rande der Tsaidam, district Barun, *A. Tafel 242* (holotype, B).

This taxon was reduced by Peng (1987) to a variety of *Limonium aureum*, but the two are quite distinct in the inflorescence rachis, which is flexuous and dichotomous in *L. aureum* and straight in *L. dielsianum*, and calyx limb color, which is golden in the former and light yellow in the latter. In my opinion, these are best treated as distinct species.

Limonium chrysocomum (Karelin & Kirilow) O. Kuntze subsp. **semenovii** (Herder) R. Kamelin, comb. et stat. nov. Basionym: *Statice semenovii* Herder in Regel & Herder, Bull. Soc. Imp. Natur. Moscou 41(1): 398. 1868. TYPE: [Kazakhstan]. Ili, Katu [Alatau], 2,500 m, 1857, *P. Semenov s.n.* (holotype, LE).

Limonium chrysocomum is a very variable species with two geographically distinct infraspecific taxa. I recognize these as subspecies and maintain subspecies *chrysocomum* as a variable taxon with three varieties, as did Peng (1987).

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Limonium callianthum (Peng) R. Kamelin, comb. et stat. nov. Basionym: *Limonium drepanostachyum* Ikonnikov-Galitzky subsp. *callianthum* Peng, Guihaia 3: 292. 1983. TYPE: China. Xinjiang: Artux, *A. J. Li & J. N. Zhu 7996* (holotype, PE).

This species was treated by Peng (1983, 1987) as a subspecies of *Limonium drepanostachyum*. The latter is endemic to Kyrgyzstan and Tajikistan and differs in having densely pubescent bracts, densely pubescent calyces 4.5–6 mm, and 3–7-flowered spikelets. *Limonium callianthum* has glabrous to very sparsely hirsute bracts, glabrous calyces 6.5–7 mm, and 2–4-flowered spikelets.

Acknowledgments. I am grateful to Ihsan Al-Shehbaz and Tatiana Shulkina for help in the preparation of the manuscript.

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Three New Combinations and a New Name in Chinese Boraginaceae

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ABSTRACT. The new combinations *Lappula karelinii* (Fischer & Meyer) R. Kamelin, *Lindelofia stylosa* (Karelin & Kirilow) Brand subsp. *pterocarpa* (Ruprecht) R. Kamelin, and *Onosma setosa* Ledebour subsp. *transrhymnense* (Klokov ex M. Popov) Kamelin are made, and the new name *O. liui* R. Kamelin & T. Popova is proposed.

The revision of the Boraginaceae for the *Flora of China* is in progress, and this study has shown that four nomenclatural adjustments are needed in the genera *Lindelofia*, *Lappula*, and *Onosma*. These changes are proposed here to make the names available for the forthcoming volume 16 of the *Flora*.

Lappula karelinii (Fischer & Meyer) R. Kamelin, comb. nov. Basionym: *Echinospermum karelinii* Fischer & Meyer, Ind. Sem. Hort. Petrop. 11: 67. 1845. TYPE: [Kazakhstan]. Soongaria. Grown at St. Petersburg Botanical Garden by C. A. Meyer in 1845 from seed collected by G. Karelin (holotype, LE).

Lappula xinjiangensis C. Y. Yang ex C. J. Wang, Bull. Bot. Res. (Harbin) 1(4): 84. 1981, syn. nov. TYPE: China. Xinjiang: Burqin Xian, Ertix He, alt. 400 m, 28 May 1972, *C. Y. Yang A-720042* (holotype, XJA).

Lappula karelinii was treated by Popov (1953) as a variant of *L. tenuis* (Ledebour) Gürke, but the latter has a white tuberculate disk and nutlet sides instead of the smooth and polished disk and nutlets characteristic of *L. karelinii*. Wang (1981) described *L. xinjiangensis* C. Y. Yang ex C. J. Wang, but this plant is clearly conspecific with *L. karelinii*.

Lindelofia stylosa (Karelin & Kirilow) Brand subsp. **pterocarpa** (Ruprecht) R. Kamelin, comb. et stat. nov. Basionym: *Solenanthus nigricans* Schrenk var. *pterocarpus* Ruprecht, Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 7, 14(4): 62. 1869. TYPE: [Kyrgyzstan]. Tian-Shan, Dshaman-daban Pass, 19 July 1857, *Osten-Sacken s.n.* (holotype, LE).

Subspecies *pterocarpa* was treated by Popov (1953) as a distinct species, although he argued that it probably deserves only a subordinate rank. It differs from subspecies *stylosa* by its dentate narrow wing on the nutlet margin. In contrast, subspecies *stylosa* has small, anchorlike prickles along the nutlet margin.

Onosma liui R. Kamelin & T. Popova, nom. nov. Replaced name: *Onosma strigosum* Y. L. Liu, Acta Phytotax. Sin. 18: 65. 1980, non *O. strigosum* Steven, Bull. Soc. Nat. Moscou 24: 594. 1851. TYPE: China. Sichuan: Rangtang, alt. 3,400 m, July 1975, *no collector name*, #9355 (holotype, CDBI).

Onosma setosa Ledebour subsp. **transrhymnense** (Klokov ex M. Popov) Kamelin, comb. et stat. nov. Basionym: *Onosma transrhymnense* Klokov ex M. Popov, Spisok Rast. Gerb. Fl. SSSR 12: #3564. 1953. TYPE: [Kazakhstan]. Between Chernojarskoe and Pavlodar, on Irtysch River, 2 June 1890, *P. Schmidt s.n.* (holotype, LE).

This subspecies differs from subspecies *setosa* in having yellow-green hirsute upper parts of the plant and corollas 1.5–1.8(–2) cm long. Subspecies *setosa* has whitish gray hirsute upper parts and corollas 2–2.2(–2.5) cm long. Both subspecies are distributed in Xinjiang Province (China), Russia, and Kazakhstan, but subspecies *transrhymnense* extends into Mongolia as well. *Onosma setosa* was treated by Liu (1989) as *O. echioides* L., but the latter is an entirely different species.

Acknowledgments. I am indebted to Ihsan Al-Shehbaz and Tatiana Shulkina for help in the preparation of this manuscript.

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Wang, Ching-jui. 1981. A study of the genus *Lappula* of China. Bull. Bot. Res. (Harbin) 1(4): 77–100.

New Combinations in *Panzerina lanata* (Lamiaceae) for the *Flora of China*

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ABSTRACT. In order to make names available for use in the *Flora of China*, the following combinations are made: *Panzerina lanata* var. *alaschanica* (L. Kuprianaov) H. W. Li, *Panzerina lanata* var. *albescens* (L. Kuprianova) H. W. Li, *Panzerina lanata* var. *argyracea* (L. Kuprianova) H. W. Li, and *Panzerina lanata* var. *parviflora* (C. Y. Wu & H. W. Li) H. W. Li.

Panzerina was published by Soják (1981) to replace *Panzeria* Moench, a later homonym of *Panzeria* J. F. Gmelin. Two species, *P. canescens* (Bunge) Soják and *P. lanata* (L.) Soják, with four varieties, will be recognized in the *Flora of China*. Although the genus was recently revised by Krestovskaja (1991), she used *Panzeria* rather than *Panzerina*. The needed new combinations in *Panzerina* are made here.

Panzerina Soják, Čas. Nár. Muz. Praze, Řada Přír. 150: 216. 1981 [1982]. TYPE: *Panzerina lanata* (L.) Soják, *Ballota lanata* L.

Panzeria Moench, Methodus 402. 1794, not *Panzeria* J. F. Gmelin, Syst. Nat. 2: 247. 1791.

Panzerina lanata (L.) Soják, Čas. Nár. Muz. Praze, Řada Přír. 150: 216. 1981 [1982]. Basionym: *Ballota lanata* L., Sp. Pl. 2: 582. 1753.

Panzerina lanata var. **lanata**

Panzerina lanata var. **alaschanica** (L. Kuprianova) H. W. Li, comb. nov. Basionym: *Panzeria alaschanica* L. Kuprianova, Bot. Mater. Gerb. Bot. Inst. Komarova Acad. Nauk SSSR 15: 363. fig. 6. 1953. *Panzeria lanata* var. *alaschanica* (L. Kuprianova) O. V. Tscherneva, Rast. Centr. Azii, Mater. Bot. Inst. Komarov 5: 68. 1970. TYPE: "Mongolia australis, Muni-Ula, *N. Przewalski*, 1871."

Panzerina lanata var. **albescens** (L. Kuprianova) H. W. Li, comb. nov. Basionym: *Panzeria albescens* L. Kuprianova, Bot. Mater. Gerb. Bot. Inst. Komarova Acad. Nauk SSSR 15: 362. 1953. *Panzeria lanata* var. *albescens* (L. Kuprianova) T. Krestovskaja, Novosti Sist. Vyss. Rast. 28: 144. 1991. TYPE: "Mongolia australis, in distr. Gobi Media, prope pag. Erdeni-Dalaj, *V. Grubov 7028*."

Panzerina lanata var. **argyracea** (L. Kuprianova) H. W. Li, comb. nov. Basionym: *Panzeria argyracea* L. Kuprianova, Bot. Mater. Gerb. Bot. Inst. Komarova Acad. Nauk SSSR 15: 364. 1953. *Panzeria lanata* var. *argyracea* (L. Kuprianvoa) Sergievskaja, Fl. Zap. Sib. 12(2): 3431. 1964. TYPE: [Russia] "Tuvink. prov. lacibu Teri-Chol, *K. Sobolevskaja*, 1947."

Panzerina lanata var. **parviflora** (C. Y. Wu & H. W. Li) H. W. Li, comb. nov. Basionym: *Panzeria parviflora* C. Y. Wu & H. W. Li Acta Phytotax. Sin. 10: 164. 1965. *Panzeria lanata* var. *parviflora* (C. Y. Wu & H. W. Li) T. Krestovskaja, Novosti Sist. Vyss. Rast. 28: 144. 1991. TYPE: [China] "Sinkiang: loc. ign., *Academia Agriculturae Sinkiangensis 2013*. (Typus HP)."

Literature Cited

Krestovkaja, T. 1991. Conspectus generis *Panzeria* Moench (Lamiaceae). Novosti Sist. Vyss. Rast. 28: 140–144.

Soják, J. 1981 [1982]. K nomenklature *Panzeria* Moench (Labiatae) a *Paulia* Korov. (Umbelliferae). Čas. Nár. Muz. Praze, Řada Přír. 150: 216.

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Goydera—A New Genus of Asclepiadaceae from Somalia

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ABSTRACT. A new genus of Asclepiadaceae, *Goydera*, from Somalia, is described. The new genus is related to the African genera *Blyttia* and *Diplostigma* and is characterized by colorless latex, a highly fused, adaxially densely pubescent corolla, and a bulge carrying the gynostegium.

During an ongoing revision of the subtribe *Cynanchinae* (Asclepiadeae, Asclepiadaceae), several unnamed specimens from Somalia were discovered which, on first sight, were thought to represent a new species of *Cynanchum* L. While the circumscription of *Cynanchum* is notoriously difficult, the main question, the inclusion of *Vincetoxicum* Wolf, has no bearing on the description of the present taxon, as its characters agree even less with *Vincetoxicum* than with *Cynanchum* s. str.

The corona, widely used in Asclepiadaceae systematics, provides the first hint that the new species would be ill-accommodated in *Cynanchum*. While both *Cynanchum* and the new taxon share the basic corona structure of highly fused staminal and interstaminal parts, in *Cynanchum* at least the staminal parts attain the height of the gynostegium. In the new taxon, however, the indistinguishable staminal and interstaminal corona parts form an annulus, which just reaches the lower entrance of the guide rails. The mismatch with *Cynanchum* is supported by a range of other characters. All species of *Cynanchum*, with exception of the aberrant and probably misplaced North American *C. laeve* (Michaux) Persoon, possess milky latex. Because latex characters seem to be highly conservative (Liede & Mahlberg, unpublished), this character strongly supports the exclusion of the new species from *Cynanchum*. The highly fused elongated-conical corolla, the long trichomes covering its adaxial surface, the minute size of the flowers, and the sharply geniculate caudicles constitute characters not encountered in *Cynanchum*. Colorless latex, tiny flowers, and long trichomes on the adaxial surface of the corolla, however, are encountered in the small East African/Arabian genera *Blyttia* Arnott and *Diplostigma* K. Schumann. However, these genera possess a different corona structure, which does not allow inclusion of the taxon into either genus. A new genus thus has to be created.

Goydera Liede, gen. nov. TYPE: *Goydera somaliense* Liede.

Blyttiae et *Diplostigmae* affine, sed corolla alte connata et intus dense pubescencenti differt. Corona a gynostegio originans, ex partibus staminodialibus et interstaminodialibus constans.

Plants containing colorless latex. *Inflorescences* one per node, constituting a scorpioid cyme or an inflorescence type derived from it. *Corolla* fused for more than half of its height, adaxially densely covered with long, slender trichomes. *Corona* gynostegial, consisting of fused staminal and interstaminal parts, shorter than the gynostegium. *Gynostegium* elevated by a bulge. *Pollinia* pendulous.

The taxon is named after David J. Goyder, Kew, who directed my interest to this unusual plant.

Goydera somaliense sp. nov. TYPE: Somalia. Hiiraan Region: Bulo Burti District, 03°46′N, 44°57′E, 13 km NNE of Dharyio, ± 300 m, 29 Nov. 1986, *Kuchar 17188* (holotype, K). Figure 1.

Herba volubilis, foliis lineariformibus, corolla conica, corona brevi annulari.

Plants twining, 50–70 cm high, sparsely basitonically branched, sarmentose, runners corky. *Shoots* herbaceous, glabrous; internodes 4–7 cm long, 0.6–1 mm diam.; latex sparse, colorless. *Leaves* sessile, lacking colleters; leaf blades herbaceous, linear, 12–15 mm long, 0.5–0.7 mm wide, apically acute, adaxially glabrous, abaxially sparsely indumented with erect, 200–250-μm-long trichomes; indumentum restricted to veins and margins. *Inflorescences* umbelliform, 10–15-flowered, 8–12 flowers open at the same time, pedunculate; peduncles 5–7 mm long, glabrous. *Floral bracts* 0.4–0.5 mm long, 0.2–0.3 mm wide at the base, ovate, with trichomes; pedicels 2–3 mm long, glabrous. *Buds* 2.5–3 mm long, 1.3–1.5 mm diam., conical, aestivation imbricate. *Calyx* basally fused, rotate, ciliate; sepals 1.7–1.8 mm long, 0.6–0.7 mm wide, triangular, apically acute. *Corolla* elongated-conical, fused for ⅞ of its height, 3.5–4 mm high, 1–1.5 mm wide, rugose, glabrous, abaxially yellow to brown, adaxially densely covered with long tri-

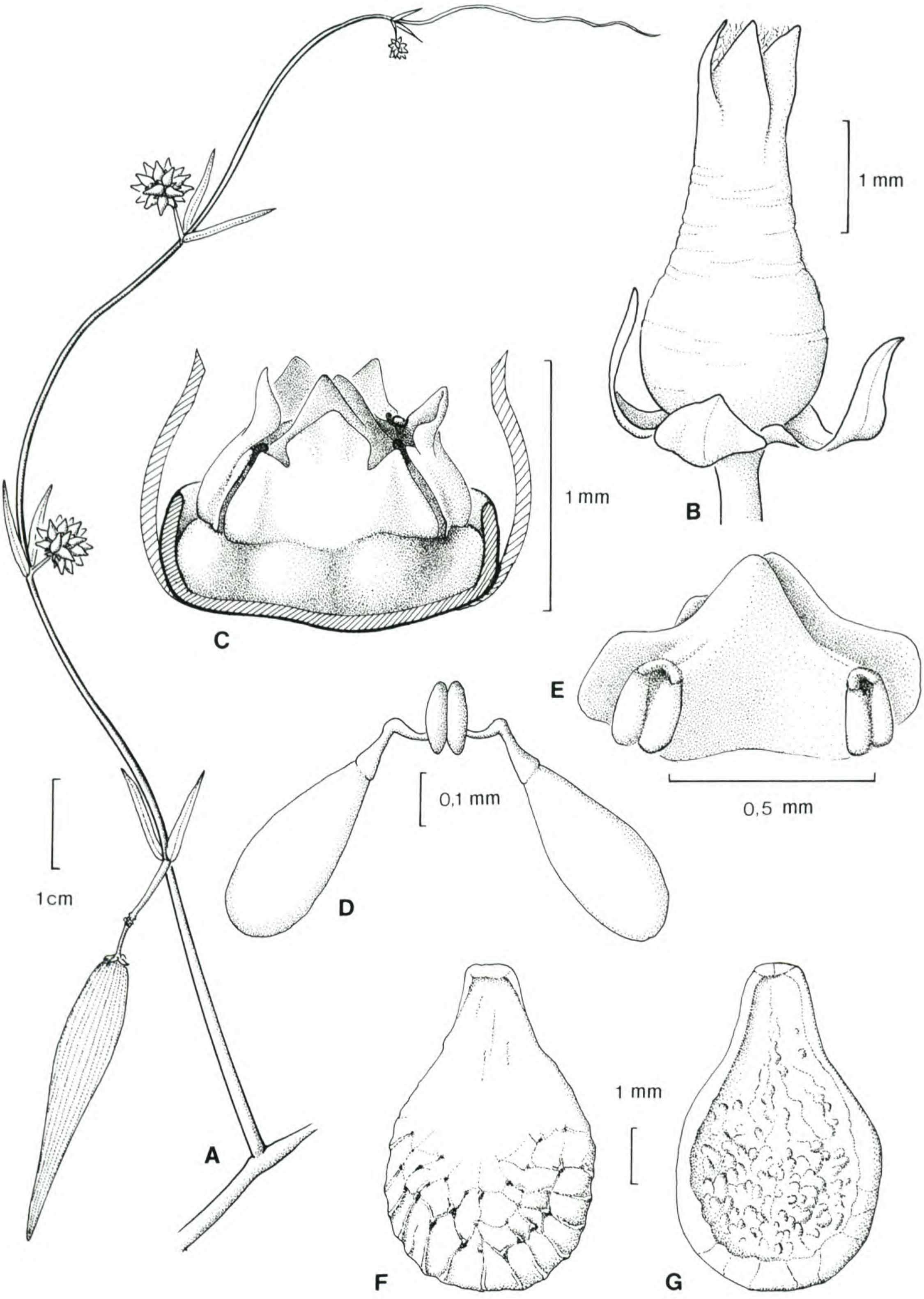

Figure 1. *Goydera somaliense* Liede. —A. Habit, inflorescences, and fruit. —B. Flower. —C. Flower, corolla and corona removed showing gynostegium and the bulge elevating it. —D. Pollinarium. —E. Stylar head. —F. Seed, aseta side. —G. Seed, seta side (*Kuchar 17188*).

chomes; corolla lobes erect, ovate to lanceolate, apically acute. *Corona* cyathiform, 350–450 mm high, shorter than the gynostegium; staminal and interstaminal parts completely fused, upper corona margin straight. *Gynostegium* elevated by a bulge of 300–350 μm, 750–850 μm high without bulge, 1,200–1,300 μm diam. *Anthers* broader than high, trapezoidal, abaxially planar; anther wings 350–400 μm long, extending along the whole length of the anther, convergent, consisting of proximal and distal ridge, proximal ridge curved, space between distal and proximal ridge bristly. Anther wings of adjacent anthers parallel to each other, in the same plane as the anther. Connective appendages 300–350 μm long, 350–400 μm wide, deltate, broader than the stamen. *Pollinarium:* corpusculum 150 μm long; caudicles (sub-)basally inserted at the corpusculum, 180–200 μm long, cylindrical, convexly recurved, thickened at the insertion of the pollinium, geniculate; pollinia apically attached to the caudicles, 340–380 μm long, 160–180 μm wide, ovate in cross section, clavate. *Stylar head* 650–750 μm diam., 400–450 μm high, forming a nose at the upper end of the corpusculum; upper part 200–250 μm high, equaling the lower part in height, conical. *Follicles* always one per flower, pendulous, 40–45 mm long, 4–5 mm wide, obclavate, round in cross section, apically strongly beaked, wingless; light brown, longitudinally grooved. *Seeds* 3.5–4 mm long, 2–2.2 mm wide, pyriform, medium brown, dorsally papillose with knottily arranged papillae, ventrally papillose with papillae arranged in longitudinal ridge; coma 10–12 mm long. *Chromosome number:* unknown.

Distribution. Somalia, 4°05′–2°40′N, 42°20′–45°30′E, on limestone, in *Acacia–Commiphora* bushland.

Flowering time. November–December, May.

Paratypes. SOMALIA. **Hiiraan Region:** 03°53′N, 44°50′E, El Dabbo 23 km E of Dhanabo, ± 345 m, 24 May 1983, *Gillett & Hemming 24405* (K). **Bulo Burti District:** 04°02′N, 45°23′E, 4 km N of Bulo Burti, ± 600 m, 24 Dec. 1972, *Bally & Melville 15308* (K, MO). **Hiiraan District:** 04°03′N, 45°45′E, escarpment above Yasoomman, 300 m, 28 May 1989, *Thulin & Abdi Dahir 6486.* (K).

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Nomenclatural Changes and New Taxa in *Claytonia* (Portulacaceae) in Western North America

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ABSTRACT. *Claytonia* here includes all annual *Montia* species with principally basal leaves and scapiform inflorescences bearing one pair of free or fused cauline leaves. Three morphologically distinctive diploids define the basic species of a polymorphic polyploid complex formerly named *C. perfoliata* sensu lato. In this complex, we propose two new subspecies, *C. perfoliata* subsp. *intermontana* and *C. parviflora* subsp. *grandiflora*, and four subspecific combinations. A perfoliate-leaved subspecies of *C. exigua* is newly recognized.

Through the work of Swanson (1966), Nilsson (1967), McNeill (1975), and others, the genus *Claytonia* is coming to be accepted in a more inclusive sense than was common in monographic and floristic works of the first half of this century (e.g., Howell, 1893; Pax & Hoffmann, 1934; Ferris, 1944; Hitchcock, 1964). In what now seems to be an unjustified generic split, certain taxa of rhizomatous perennials and annuals that were classified in *Claytonia* prior to 1893 had been segregated into *Montia*. Morphological evidence including pollen (Nilsson, 1967), growth habit (Swanson, 1966), and chromosome numbers (Lewis & Suda, 1968; Fellows, 1975; Miller & Chambers, 1977), along with numerical taxonomic analysis (McNeill, 1975), now places the following former *Montia* species more naturally in *Claytonia: C. arenicola* L. F. Henderson, *C. cordifolia* S. Watson, *C. exigua* Torrey & A. Gray (= *C. spathulata* Douglas ex Hooker, nom. illeg.), *C. gypsophiloides* Fischer & C. A. Meyer, *C. perfoliata* Donn ex Willdenow, *C. saxosa* T. S. Brandegee, and *C. sibirica* L. These taxa differ from *Montia*, as redefined by McNeill (1975), in having their principal leaves in a basal rosette and in possessing inflorescences borne on scapelike stems with only a single pair of cauline leaves, which may be united into a bilobed or toothed disk. We propose to add *C. parviflora* Douglas ex Hooker and *C. rubra* (Howell) Tidestrom to the above list of recognized species that were earlier assigned to *Montia*. The latter genus, while still diverse (nine sections for only 13 species, as recognized by McNeill (1975)), differs from *Claytonia* in having numerous stem leaves, which may be alternate or opposite, in lacking a basal leaf rosette, and in having pantocolpate pollen rather than the trizonocolpate type characteristic of *Claytonia*. In habit, *Montia* species are annuals or rhizomatous to stoloniferous perennials, lacking the fleshy taproots or tuberlike underground storage organs seen in many perennial species of *Claytonia*.

The group of taxa that had previously been united as the polymorphic species *Claytonia perfoliata* sensu lato was shown by Miller (1976, 1978) to be a polyploid, largely autogamous pillar complex based upon three morphologically distinct diploid entities ($n = 6$). When raised to species rank, these entities fall within the already named taxa *C. perfoliata*, *C. parviflora*, and *C. rubra*. Together with the putatively ancestral diploids, each of these species includes a variable array of eupolyploids ranging from tetraploid to, in some cases, as high as decaploid (Miller, 1978). Many polyploid races have intermediate morphologies suggestive of an alloploid origin, but some races, especially at the tetraploid level, are scarcely distinguishable from the basic diploids and may be intraspecific autoploids.

Our taxonomic proposal for the *C. perfoliata* complex sensu lato is to recognize as species the three taxa mentioned above and to divide each species into a limited number of broadly defined subspecies. Within each species, one subspecies contains the basic diploid races along with polyploids that are scarcely distinguishable from them. The one or more remaining subspecies are framed around clusters of morphologically similar polyploid races, usually having a more or less well defined geographical range. The following lectotypifications, new taxa, and new combinations are necessary for this taxo-

nomic revision. *Claytonia exigua* subsp. *glauca*, *C. parviflora* subsp. *grandiflora*, *C. parviflora* subsp. *viridis*, *C. perfoliata* subsp. *mexicana*, and *C. rubra* subsp. *depressa* appeared earlier in *The Jepson Manual* (Hickman, 1993) and are here being validated.

Claytonia perfoliata Donn ex Willdenow, Sp. Pl. 1: 1186. 1798. *Limnia perfoliata* (Donn ex Willdenow) Haworth, Syn. Pl. Succ. 12. 1812. *Montia perfoliata* (Donn ex Willdenow) Howell, Erythea 1: 38. 1893. TYPE: Herbarium Willdenow No. 4984, *Cl. perfoliata* 2, Mus. Bot. Berol. Film Nr. 816a (lectotype, here designated, B-W [photograph seen]).

Authorship of this well-known name is often attributed to James Donn, who, however, only published it as a nomen nudum. Of the three sheets in Willdenow's herbarium, those numbered "1" and "2" each hold a beautifully prepared specimen, probably of garden origin. We select the sheet numbered "2" as the lectotype. A third sheet consists of four fragments only; one of these is a teratological inflorescence with separate cauline leaves, which evidently entered into Willdenow's description, in part. This "inaccuracy" (Sims, 1811) may have led to some confusion about Willdenow's plant among contemporary botanists, who were familiar with the typically perfoliate-leaved species because of its rapid, spontaneous spread among European botanical gardens after being introduced to Kew Gardens in 1796. The date and place of introduction were given by Sims (1811), who credits Archibald Menzies as the discoverer of the species. There is a sheet at BM on which three specimens are marked as having been collected by Menzies on the "North-west coast of America. 1792-3-4" (Photo No. 917-1, NY).

Claytonia perfoliata Donn ex Willdenow subsp. **mexicana** (Rydberg) Miller & Chambers, comb. nov. Basionym: *Limnia mexicana* Rydberg, N. Amer. Fl. 21: 309. 1932. *Montia mexicana* (Rydberg) Pax & K. Hoffmann, Nat. Pflanzenfam. ed. 2 16c: 259. 1934. *Claytonia tolucana* Holub, Preslia 47: 328. 1975. TYPE: Mexico. México: Nevada de Toluca, *Rose & Painter 7924* (holotype, US).

Limnia cuprea Heller, Muhlenbergia 2: 279. 1907, syn. nov. *Montia perfoliata* forma *cuprea* (Heller) J. T. Howell, Leafl. W. Bot. 5: 106. 1948. TYPE: U.S.A. California: Monterey County, Pacific Grove, *Heller 8501* (holotype, BKL [at NY]; isotypes, DS, NY, WTU).

Limnia platyphylla Rydberg, N. Amer. Fl. 21: 307. 1932, syn. nov. *Montia platyphylla* (Rydberg) Pax & K. Hoffmann, Nat. Pflanzenfam. ed. 2 16c: 259. 1934. *Claytonia platyphylla* (Rydberg) Holub, Preslia 47: 328. 1975. TYPE: U.S.A. California: [Santa Barbara County,] Gaviota Pass, *Brewer 384* (holotype, US).

Limnia guadalupensis Rydberg, N. Amer. Fl. 21: 311. 1932, syn. nov. TYPE: Mexico. Baja California: Guadalupe Island, *Palmer 15* (holotype, NY; isotypes, F, NY).

The diploid elements of the above subspecies were characterized by Miller (1978: figs. 6–9) as having linear juvenile leaves and broadly deltate, mucronate adult leaves; their fully perfoliate cauline leaf disk has two mucronate teeth. Together with related polyploids they range widely through the Coast Ranges of California to Baja California, Arizona, and mainland Mexico, reaching the highlands of Guatemala.

Claytonia perfoliata Donn ex Willdenow subsp. **intermontana** Miller & Chambers, subsp. nov. TYPE: U.S.A. Nevada: Churchill County, Highway 50, 8 mi. E of Eastgate, 7 mi. W of Carroll Summit, $2n = 24$ [by J. R. Swanson], *H. K. Sharsmith 4767* (holotype, OSC).

A subsp. *perfoliata* caulibus foliisque patulis vel erectis saepe rubello-viridis, discis perfoliatis saepe hemidivisis differt; a subsp. *mexicana* caulibus foliisque saepe rubello-viridis, foliis adultis ovato-rhombeis vel subdeltatis raro mucronatis, discis perfoliatis saepe hemidivisis differt.

Plants annual, 2–20 cm tall, often red-pigmented (shade-grown plants usually green); stems and leaves erect to lax and spreading; juvenile rosette leaves linear to oblanceolate; adult leaves with petiole 2 or more times the blade, blade 0.5–4 cm, ovate-rhomboid to subdeltate, acute, rarely mucronate; cauline leaf-disk perfoliate, often notched or divided to the stem on one side; inflorescence usually 5–20-flowered, compact and sessile on the leaf-disk or racemosely elongated up to 5 cm; flowers self-pollinating; sepals 2–3.5 mm, orbicular; petals 2.5–4 mm, white or pinkish; capsule 2.5–3 mm; seeds 3, shiny black, with conspicuous elaiosome; $2n = 24, 36, 48$.

This subspecies is distributed widely in the intermontane region east of the Cascade Range, Sierra Nevada, and Peninsular Ranges, from British Columbia to northern Baja California and Arizona, east to the Rocky Mountains. The genetic influence of *Claytonia rubra* is seen in the frequent reddish coloration of the polyploids comprising this taxon, and their characteristic ovate-rhomboid leaf shape is intermediate between the deltoid leaves of *C. rubra* and the linear ones of *C. parviflora*. Furthermore, polyploid *C. parviflora* subspp. *parviflora* and *utahensis* (see below) are frequently sympatric and intergradent with *C. perfoliata* subsp. *intermontana*,

in a pattern similar to the intergradation of polyploid *C. perfoliata* subsp. *perfoliata* and *C. parviflora* subsp. *parviflora* in the cismontane region of the Pacific States.

Claytonia rubra (Howell) Tidestrom, Contr. U.S. Natl. Herb. 25: 188. 1925. Basionym: *Montia rubra* Howell, Erythea 1: 38. 1893. *Limnia rubra* (Howell) Heller, Muhlenbergia 6: 84. 1910. *Claytonia perfoliata* Donn ex Willdenow var. *rubra* (Howell) Poellnitz, Repert. Spec. Nov. Regni Veg. 30: 301. 1932. TYPE: U.S.A. Washington: [Klickitat or Yakima County,] Simcoe (as "Cimcoe") Mountains, June 1880, *T. J. Howell s.n.* (lectotype, here designated, ORE; isolectotype, US).

Howell cited no type or other specimens in his description of *Montia rubra*. The above lectotypification allows this name to be associated with the common and widespread diploid entity that forms one of the three pillars of the *Claytonia perfoliata* sensu lato polyploid complex. The name *Claytonia parviflora* var. *depressa* A. Gray, which in the literature has often been applied to *C. rubra* subsp. *rubra*, is lectotypified below to apply to a different, wholly polyploid subspecies.

Claytonia rubra (Howell) Tidestrom subsp. **depressa** (A. Gray) Miller & Chambers, comb. nov. Basionym: *Claytonia parviflora* Douglas ex Hooker var. *depressa* A. Gray, Proc. Amer. Acad. Arts 22: 281. 1887. *Montia parviflora* (Douglas ex Hooker) Howell var. *depressa* (A. Gray) B. L. Robinson, Syn. Fl. N. Amer. 1: 274. 1897. *Montia depressa* (A. Gray) Suksdorf, Deutsche Bot. Monatsschr. 16: 221. 1898. *Limnia depressa* (A. Gray) Rydberg, Bull. Torrey Bot. Club 33: 139. 1906. *Claytonia parviflora* Douglas ex Hooker subsp. *depressa* (A. Gray) Piper, Contr. U.S. Natl. Herb. 11: 250. 1906. *Montia perfoliata* (Donn ex Willdenow) Howell var. *depressa* (A. Gray) Jepson, Fl. Calif. 1: 471. 1914. *Claytonia perfoliata* Donn ex Willdenow var. *depressa* (A. Gray) Poellnitz, Repert. Spec. Nov. Regni Veg. 20: 301. 1932. TYPE: U.S.A. Washington: [San Juan County,] San Juan Island, *Lyall* in 1858 (lectotype, here designated, GH).

Montia humifusa Howell, Fl. N.W. Amer. 1: 96. 1897, syn. nov. *Limnia humifusa* (Howell) Rydberg, Fl. Plains N. Amer. 313. 1932. *Claytonia humifusa* (Howell) Holub, Preslia 47: 328. 1975. TYPE: U.S.A. Oregon: [Umatilla County,] Milton, 18 May 1896, *T. J. Howell s.n.* (holotype, ORE; isotype, DS).

Montia latifolia Suksdorf, Deutsche Bot. Monatsschr. 16: 222. 1898, syn. nov. *Claytonia latifolia* (Suksdorf) Suksdorf, Werdenda 1: 222. 1923, non Sheldon, 1894. TYPE: U.S.A. Washington: [Klickitat County,] Bingen, *Suksdorf 1881* (holotype, WS; isotypes, F, GH, NY, UC, US).

Montia interrupta Suksdorf, Deutsche Bot. Monatsschr. 16: 222. 1898, syn. nov. *Claytonia interrupta* (Suksdorf) Suksdorf, Werdenda 1: 222. 1923. *Limnia interrupta* (Suksdorf) Rydberg, N. Amer. Fl. 21: 308. 1932. TYPE: U.S.A. Washington: [Klickitat County,] Bingen, *Suksdorf 2009* (holotype, WS; isotypes, F, GH, NY, UC, US).

Claytonia cupulata Suksdorf, Werdenda 1: 11. 1923, syn. nov. TYPE: U.S.A. Washington: [Klickitat County,] Bingen, *Suksdorf 10169* (holotype, WS; isotypes, CAS, DS, NY, OSC, UC, US).

Claytonia rubra subsp. *depressa* differs from subspecies *rubra* in being wholly polyploid (tetraploid and hexaploid) and in having ovate-elliptic leaf blades rather than deltate, sometimes cordate blades as in subspecies *rubra*. It is generally found at lower elevations than subspecies *rubra*, occurring in coastal sandy sites from British Columbia to northern California, as well as interior regions from Washington to northern Nevada and east to Montana. In an earlier paper, it was referred to as the "sagebrush hexaploid" and the "coastal tetraploid" (Miller, 1978: figs. 1, 6). Its foliage may be reddish, as is common in subspecies *rubra*, or green; the epithet "depressa" is descriptive of its often cushionlike growth form.

Claytonia parviflora Douglas ex Hooker subsp. **grandiflora** Miller & Chambers, subsp. nov. TYPE: U.S.A. California: Calaveras County, San Antonio Creek S of Sheep Ranch, on the road to Murphy's, *Miller 666* (holotype, OSC; isotypes, CAS, RSA, SD).

A subsp. *parviflora* floribus allogamis, petalis 4–6 mm quam sepalis duplo triplove longioribus differt.

Plants annual, 5–20 cm tall, sometimes red-pigmented; stems and leaves erect or somewhat spreading; juvenile and adult leaves linear; cauline leaf-disk perfoliate, rarely notched or divided; inflorescence longer than the leaves, 5–30-flowered, the flowers racemosely arranged and well exserted above the perfoliate disk; sepals 2–3.5 mm, ovate; petals 4–6 mm, white or pink; stamens releasing pollen 1–2 days before the stigmas are receptive, the breeding system allogamous; capsules 2.5–3 mm; seeds 3, shiny black, with conspicuous elaiosome; $2n = 12$.

Of the three morphologically divergent diploid taxa forming the bases for the *Claytonia perfoliata* polyploid complex, *C. parviflora* subsp. *grandiflora*

is the only one having an outcrossing, self-incompatible breeding system. A similar floral syndrome and breeding system occur in the diploid annual species *C. gypsophiloides*, a basal and putatively primitive element in the *C. exigua* polyploid complex. *Claytonia parviflora* subsp. *grandiflora* occupies a natural range in the mixed oak-pine woodlands on the western slopes of the Sierra Nevada at 150–1,200 m elevation. It sometimes is sympatric with polyploid, autogamous races of subspecies *parviflora*.

Claytonia parviflora Douglas ex Hooker subsp. **utahensis** (Rydberg) Miller & Chambers, comb. nov. Basionym: *Limnia utahensis* Rydberg, Bull. Torrey Bot. Club 39: 314. 1912. *Claytonia utahensis* (Rydberg) Tidestrom, Contr. U.S. Natl. Herb. 25: 188. 1925. *Claytonia perfoliata* Donn ex Willdenow var. *utahensis* (Rydberg) Poellnitz, Repert. Spec. Nov. Regni Veg. 30: 302. 1932. *Montia utahensis* (Rydberg) Pax & K. Hoffmann, Nat. Pflanzenfam. ed. 2 16c: 259. 1934. *Montia perfoliata* (Donn ex Willdenow) Howell var. *utahensis* (Rydberg) Munz, Aliso 4: 90. 1958. TYPE: U.S.A. Utah: [Washington County,] St. George, *Palmer* in 1877 (holotype, NY).

Claytonia parviflora subsp. *utahensis* comprises populations of generally diminutive plants whose spathulate to narrowly lanceolate adult leaf blades are 4 mm or more wide, and which occupy the Peninsular and Desert ranges of southern California, extending north on the east flank of the Sierra Nevada and east to southern Nevada, Utah, and northern Arizona. The plants are autogamous and principally tetraploid. Intergradent populations have been noted between this subspecies and both *C. perfoliata* subsp. *intermontana* and *C. parviflora* subsp. *viridis* (see below).

Claytonia parviflora Douglas ex Hooker subsp. **viridis** (Davidson) Miller & Chambers, comb. nov. Basionym: *Montia spathulata* (Douglas ex Hooker) Howell var. *viridis* Davidson, Bull. S. Calif. Acad. Sci. 5: 61. 1907. *Montia exigua* (Torrey & A. Gray) Jepson var. *viridis* (Davidson) Jepson, Fl. Calif. 1: 473. 1914. *Claytonia exigua* Torr. & A. Gray var. *viridis* (Davidson) Poellnitz, Repert. Spec. Nov. Regni Veg. 30: 313. 1932. *Limnia viridis* (Davidson) Rydberg, N. Amer. Fl. 21: 313. 1932. *Claytonia spathulata* Douglas ex Hooker var. *viridis* (Davidson) Munz, Fl. S. Calif. 713. 1974. *Claytonia viridis* (Davidson) Holub, Preslia 47: 328. 1975. *Claytonia perfoliata* Donn ex Willdenow subsp. *viridis* (Davidson) Fellows, Madroño 23: 297. 1975. TYPE: U.S.A. California: Los Angeles County, San Gabriel Mountains, Big Rock Creek, *Hasse & Davidson 1507* (holotype, LAM [at RSA]; isotype, GH).

Claytonia tenuifolia Torrey & A. Gray, Fl. N. Amer. 1: 201. 1838, syn. nov. *Claytonia spathulata* Douglas ex Hooker var. *tenuifolia* (Torrey & A. Gray) A. Gray, Proc. Amer. Acad. Arts 22: 282. 1887. *Montia tenuifolia* (Torrey & A. Gray) Howell, Erythea 1: 38. 1893. *Limnia tenuifolia* (Torrey & A. Gray) Rydberg, N. Amer. Fl. 21: 313. 1932. *Montia spathulata* (Douglas ex Hooker) Howell var. *tenuifolia* (Torrey & A. Gray) Munz, Man. S. Calif. Bot. 598. 1935. TYPE: U.S.A. California: *Douglas s.n.* (lectotype, here designated, GH; isolectotype, NY).

Fellows (1975) demonstrated that the above taxon is not related to the *Claytonia exigua* species-complex, as had earlier been assumed by most botanical authors. Instead, it is a member of the *C. perfoliata* complex sensu lato, based on its seed morphology (smooth, shiny testa and enlarged elaiosome), nonglaucous herbage, and chromosome base number ($x = 6$, $2n = 24$, 36). Although placed in *C. perfoliata* by Fellows, it better belongs with *C. parviflora* because its rosette leaves range from linear to narrowly oblanceolate. The cauline leaf pair strikingly mimics that of *C. exigua*, often being linear, divergent, and unfused (e.g., the type specimens of *C. tenuifolia*, cited above; Miller, 1978: figs. 14, 16) or partly fused on one side to form a crescent-shaped or two-pronged disk. This latter type of disk is present on the specimens comprising the holotype and isotype sheets of *M. spathulata* var. *viridis*, and these plants' basal leaves have a broader blade than is usual for the subspecies. The San Gabriel Mountains, along with other units of the Transverse Ranges of southern California, contain diverse morphological forms of the *C. perfoliata*—*parviflora*—*rubra* complex; these include diploids as well as several variable polyploids. Leaf-shape variation in subspecies *viridis* may be due to introgression from some broader-leaved taxa like subspecies *mexicana* or subspecies *rubra*. Other populations have been found in this region that may represent diploid introgressants of *C. perfoliata* with *C. rubra* (Miller, pers. obs.). It is not yet clear whether any additional entities within this hybrid complex are worthy of taxonomic recognition; at present, we prefer the broadly defined, and hence more variable, taxa outlined in this report.

Claytonia tenuifolia is a notable addition to the synonymy of *C. parviflora* subsp. *viridis*, above. Since the time of Asa Gray, almost all authors deal-

ing with the flora of California have associated this name with plants referable to *Claytonia exigua* (*C. spathulata* of previous treatments). However, the type specimens at GH and NY, collected by David Douglas at some unknown site in California, surprisingly prove not to belong to the latter species. Although they are similar to *C. exigua* in habit, their seed morphology is unequivocally that of *C. parviflora*. For any combinations made at the varietal level, therefore, the epithet *tenuifolia* has priority.

Claytonia exigua Torrey & A. Gray subsp. **glauca** (Torrey & A. Gray) Miller & Chambers, comb. nov. Basionym: *Claytonia parviflora* Douglas ex Hooker [var.] β *glauca* Torrey & A. Gray, Fl. N. Amer. 1: 200. 1838. *Limnia glauca* (Torrey & A. Gray) Rydberg, N. Amer. Fl. 21: 311. 1932. *Montia perfoliata* (Donn ex Willdenow) Howell subsp. *glauca* (Torrey & A. Gray) Ferris, Ill. Fl. Pacific States 2: 127. 1944. *Montia perfoliata* (Donn ex Willdenow) Howell forma *glauca* (Torrey & A. Gray) J. T. Howell, Leafl. W. Bot. 5: 106. 1948. TYPE: U.S.A. [Oregon:] "Oregon R.," *Nuttall s.n.* (lectotype, here designated, GH; probable isolectotype, NY [labeled "Rocky plains of Wahlamet"]).

Montia spathulata (Douglas ex Hooker) Howell var. *disciformis* Suksdorf, Deutsche Bot. Monatsschr. 16: 222. 1898, syn. nov. *Claytonia spathulata* Douglas ex Hooker var. *disciformis* (Suksdorf) Suksdorf, Werdenda 1: 10. 1923. TYPE: U.S.A. Washington: Klickitat County, Major Creek between Bingen and Lyle, *Suksdorf 2095* (holotype, WS; isotypes, F, GH, NY, UC, US).

Montia pallida M. Peck, Proc. Biol. Soc. Wash. 47: 185–186. 1934, syn. nov. TYPE: U.S.A. Oregon: [Marion or Polk County,] near Salem, *Peck 1699* (holotype, WILLU [at OSC]).

The name *Claytonia exigua* Torrey & A. Gray, of 1838, must replace the earlier *C. spathulata* Douglas ex Hooker, 1832, because the latter is a homonym of *C. spatulata* Eaton, 1824. The epithet *glauca* was attributed by Torrey and Gray to "Nutt.! mss." but Nuttall's tags on the type sheets show he intended the name for a variety of *C. gypsophiloides* rather than *C. parviflora* as was published in *Flora of North America*. Hence the basionym should not be attributed to "Nuttall ex Torrey & A. Gray." The subspecies is entirely diploid ($2n = 16$) and forms the perfoliate leaf-disk equivalent, within *C. exigua*, of *C. perfoliata*. The differences in habit, chromosome number, and seed morphology between these two species-complexes were touched on by Fellows (1975) in his discussion of *C. parviflora* subsp. *viridis*. That *C. exigua* includes plants with a completely perfoliate disk, as well as those with a deeply two-lobed disk or with separate cauline leaves, was known to Thomas Howell (1893), who included in his description (under *Montia spathulata*, p. 38) the phrase "involucral bracts . . . wholly united and the disk shorter on one side . . .." By later authors, however, subspecies *glauca* has either been described as a separate species or submerged in *C. perfoliata*. It may be useful to clarify the synonymy, cited here and elsewhere, from the publications of Wilhelm Suksdorf. For the new taxa he described in 1898 in the *Deutschen Botanischen Monatsschrift*, Suksdorf gave first a collection number and a name in the genus *Claytonia*, followed by an equal sign and a name in the genus *Montia*. Rydberg and other authors have cited these two names as co-equal, as though both were validly published. However, Suksdorf's 1923 paper in *Werdenda* makes clear that only the names in *Montia* were intended to be published in 1898; in fact, the 1923 paper contains many transfers of these taxa from *Montia* back to *Claytonia*. The names in *Claytonia* given in Suksdorf's 1898 paper were merely references to the herbarium labels he used in distributing his collections, prior to the revision of *Montia* by Howell in 1893.

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A New *Mouriri* (Melastomataceae) from the Dominican Republic

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ABSTRACT. A new *Mouriri* in the section *Nesophytum* has been found at 1,300 m in the Cordillera Central, Dominican Republic. Collected only in fruit, the new species can be distinguished primarily by its mostly terminal infructescence, large fruits and seeds, thick calyx lobes, and hypanthium shape, greatly modified in fruit.

A party of botanists collecting at high elevations in the Dominican Republic in 1986 found a fruiting *Mouriri* that they thought was probably a new species. On first seeing the material I thought otherwise, since at least when in fruit the plant superficially resembles *M. spathulata* of Cuba and the Dominican Republic. However, the collectors were right, as a study of details of fruit structure and other features shows.

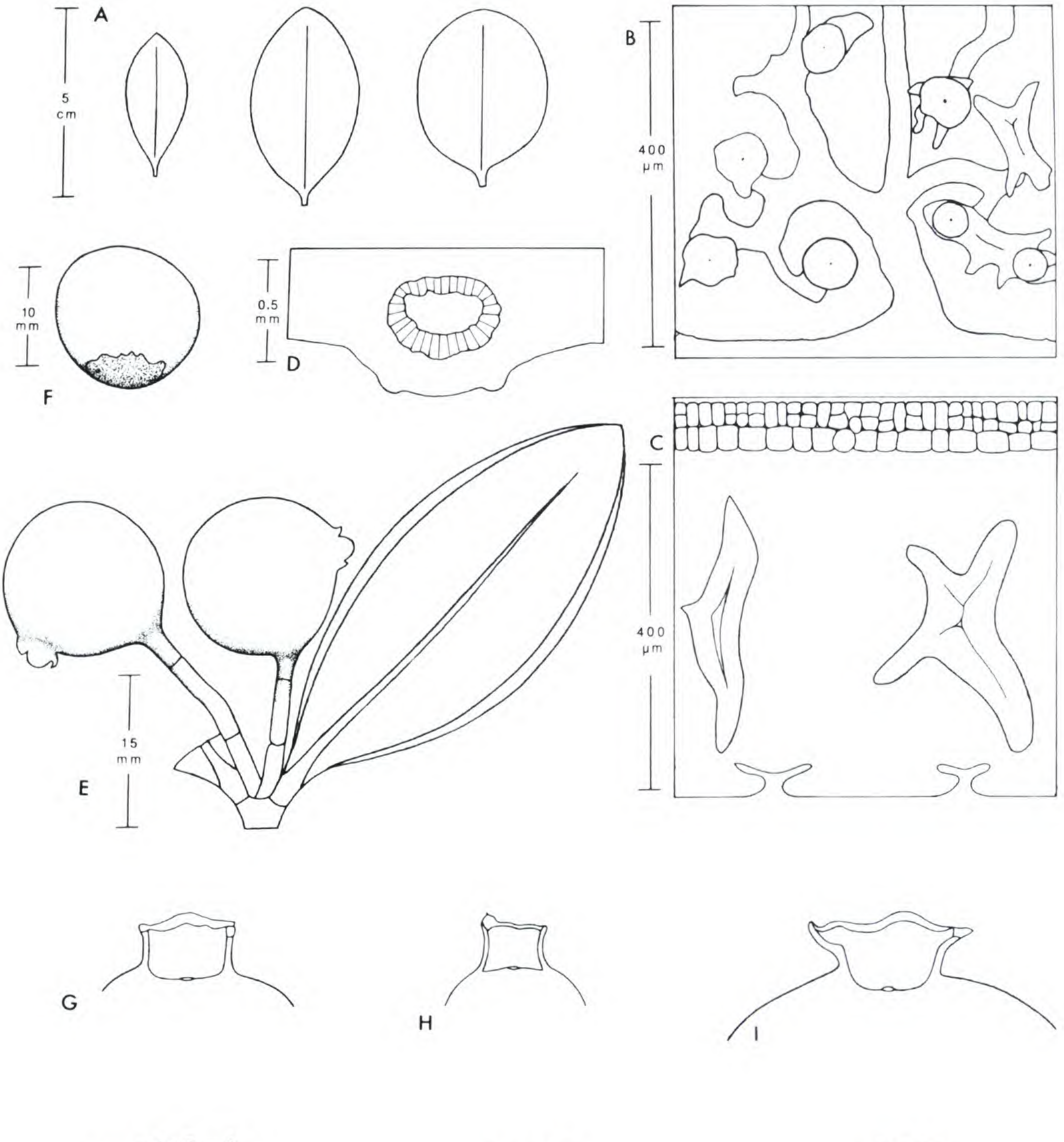
Mouriri crassisepala Morley, sp. nov. TYPE: Dominican Republic. Prov. La Vega: Cordillera Central, ladera del N de la Loma de La Sal, frente al Valle de Jarabacoa, vegetación de bosque secundario, con pinos, pero arboles latifoliados del bosque húmedo en la cima, 19°05′N, 70°35′W, alt. 1,300 m, 21 May 1986, *T. Zanoni, M. Mejia & R. Garcia 36370* (holotype, FLAS; isotype, JBSD). Figure 1.

Arbor usque 12 m alta; laminae 2.7–4.8 cm longae, 1.7–3.3 cm latae, 0.36–0.48 mm crassae, margine revoluta; cryptae stomatophorae 60–65 μm diametro; fructus plerumque terminales, raro axillares, 14–32 mm diametro; lobi calycis ad maturitatem fructus persistentes, 0.3–0.7 mm crassi; cicatrix styli 1.5–2.5 mm diametro; diameter intra hypanthii ad basim 4.2–6.6 mm; semina 14–16.5 mm longa.

Small tree to 12 m high, glabrous except for the inflorescence; young twigs round to 4-angled or rarely with small ridges at the angles. Petioles 1.5–3.5 mm long; blades 2.7–4.8 cm long, 1.7–3.3 cm wide, 0.36–0.48 mm thick, elliptic to ovate-elliptic, the margin strongly revolute, the apex rounded or seeming broadly acute through revolution of the margins, rarely mucronate, the base acute to broadly so; midrib plane above, plane to very low rounded or very low-rectangular or with two low lateral ridges below; lateral nerves not visible. Midrib xylem tubular; stomatal crypts usually Type III (Morley, 1976), Type II when small, averaging 60–65 μm diam., 28–35 μm high, 30–42 per sq. mm (extremes 35–90 μm diam., 25–40 μm high, 24–57 per sq. mm); upper epidermis 1–2 cells thick; mucilage walls none; hypodermis present; terminal sclereids from stellate with a horizontal central body and columnar branches to thick-columnar with branches at each end and no central body. Flowers unknown; fruits mostly terminal, seldom in the upper axils; peduncles 1–2 per side, each 1–3-fruited, 3–19 mm long to base of most distal pedicel measured along the axes and with 1–3 internodes in that length; bracts deciduous before fruiting. True pedicels 1.5–5 mm long, they and the axes of the inflorescence minutely puberulent or granular to glabrous; calyx lobes persistent in fruit, then 1.5–1.9 mm long from stamen attachment, 2.4–3.2 mm wide, 0.3–0.7 mm thick, rounded, seeming to have split apart ca. 0.5–0.8 mm at anthesis; petal and stamen scars dark, barely or not discernible, flush with the surface, petal scars 1.3–1.5 mm long (radially), 1.3–1.4 mm wide (circumferentially) or indistinct; antesepalous stamen scars 0.3–0.5 mm long, 0.8–1.2 mm wide, the antepetalous ones 0.4 mm long and 0.6 mm wide or indistinct; style scar 1.5–2.5 mm diam.; inside diameter of base of fruiting hypanthium 4.2–6.6 mm, less at apex, the walls thus overhanging, the overhang great in 1-seeded fruits, less in several-seeded ones; apex of fruit within hypanthium convex to flat. Fruits crowned with the calyx, 1–4-seeded, subglobose when 1-seeded, then 14–22 mm diam., lobed according to the number of seeds when seeds more than 1, up to 32 mm diam. when seeds 2–4,

→

Figure 1. A–F, *Mouriri crassisepala* Morley. —A. Leaves from various collections. —B. Cleared part of leaf blade showing veins and terminal sclereids (*Judd 5150*). —C. Cross section of leaf blade showing sclereids, upper epidermis, hypodermis, and stomatal crypts (*Judd 5150*). —D. Cross section of leaf midrib (*Zanoni 36370*). —E. Fruits, and leaf with revolute margins (*Judd 5150*). —F. Seed (*Zanoni 36370*). G–N, Lengthwise sections through the hypanthium as found on the fruit. All are one-seeded fruits except as indicated. —G. *M. helleri* var. *helleri* (*Alain Liogier*



10508). —H. *M. helleri* var. *samanensis* (*Ekman H11295*). —I, J. *M. spathulata* var. *spathulata* (I, *Morley 885*; J, *Montero 21248*). —K. *M. spathulata* var. *brachypoda*, 2-seeded (*Gonzales 2042*). —L. *M. emarginata* (*Shafer 589*). M, N. *M. crassisepala (Skean 1779)*. —M. 1-seeded. —N. 3-seeded.

TABLE 1. *Mouriri crassisepala* compared with the three other species in its section known in the fruiting condition.

	M. crassisepala	*M. spathulata*	*M. emarginata*	*M. helleri*
Leaf blade length (cm)	2.7–4.8	3–10.5	2.6–8	1–4.1
Blade thickness (mm)	0.36–0.48	0.15–0.37	0.21–0.37	0.23–0.47
Stomatal crypt diameter (μm)	60–65 av. 62.5	25–65 av. 45	30–93 av. 61.5	30–62 av. 46
Number of crypts per mm²	30–42	55–170	15–60	(0–)40–115
Inflorescence	mostly terminal	axillary	axillary	axillary or lower
Fruit diam. (mm)	14.7–32	15–30	9.5–15	7.5–12
Thickness of calyx lobes (mm)	0.3–0.7	0.1–0.2	deciduous	0.1–0.2 or deciduous
Style scar diam. (mm)	1.5–2.5	0.4–0.8	0.4–0.8	0.3–0.5
Inside diam. at base of hypanthium (mm)	4.2–6.6	2–3.1	2.8–3.3	2–2.5
Seed length (mm)	14–16.5	11.5–13.3	7.7–8.6	4.5–6

the dry measurements ca. 25% less. Seeds medium to dark brown, smooth, 14–16.5 mm long, 12.5–15.5 mm wide, 10–14 mm thick, subglobose or flattened on the contact faces when more than 1, with a roundish to angled basal hilum 5–7 mm diam.

Distribution. Known only from the montane forests of the Cordillera Central near the center of the Prov. La Vega, Dominican Republic, at 1,300–1,330 m.

Mouriri crassisepala belongs to section *Nesophytum*, which is restricted to the islands of Cuba, Hispaniola, and Puerto Rico and which contains five species including the new one (Morley, 1957). Plants of the section are characterized by small obovate leaves with tubular midrib xylem and Type III stomatal crypts, a hypodermis lacking mucilage walls, free calyx lobes, average anthers for the genus, and axile-basal to axile ovules produced only outwardly from each placenta. Of the species in the section, *M. helleri* occurs in Puerto Rico and Hispaniola, *M. gonavensis* in southwest Hispaniola, *M. spathulata* in Hispaniola and Cuba, *M. emarginata* in Cuba, and the new species in central Hispaniola.

Within the section the major distinguishing features of the new species are its thick leaves with large stomatal crypts, mostly terminal fruits, large fruits and seeds, thick persistent calyx lobes, and the hypanthium which in fruit is sunken and expanded at the base but not at the apex, producing a prominent overhang and a convex to flat ovary top.

The most difficult species to contrast with the new one is *Mouriri gonavensis* of southwest Haiti, since the latter is known only in flower, the former only in fruit. In the following comparisons the first statement refers to *M. crassisepala*, the second to *M. gonavensis:* petioles 1.5–3.5 mm long vs. 2–8 mm; blade/petiole ratio 12–18(–24) vs. usually 7–11; blade margins strongly revolute vs. usually flat to somewhat revolute; blade thickness 0.36—0.48 mm vs. 0.25–0.27 mm; stomatal crypt average diameter 62.5 μm vs. 50 μm, average frequency 36 per sq. mm vs. 42.5; flowers mostly terminal but sometimes in subterminal axils vs. axillary or sometimes at nodes below the leaf zone; calyx lobe length from stamen attachment 1.5–1.9 mm (fruit) vs. 1.7–2.5 (flower); number of ovary locules probably up to 5 judging by the seeds in the fruit vs. 2–3; elevation 1,300–1,330 m vs. 700–1,100 m.

While further information obviously would be desirable, these comparisons better support an interpretation of these plants as different species rather than the same.

The remaining three species in the section are contrasted with *Mouriri crassisepala* in Table 1. *Mouriri helleri* is least like *M. crassisepala* because of the former's small leaves, fruits, and seeds, numerous small stomatal crypts, and little modified fruiting hypanthium. *Mouriri spathulata* resembles *M. crassisepala* in having large fruits and seeds and persistent calyx lobes, but disagrees in its smaller and more numerous stomatal crypts, axillary inflorescence, thin calyx lobes, small style scar, and only slightly modified fruiting hypanthium. *Mouriri emarginata* is more like the new species in having few large crypts and a fruiting hypanthium smaller than but similar in form to that of *M. crassisepala*, but differs in its thinner leaves, axillary inflorescence, smaller fruits, seeds, hypanthium base, and style scar, and deciduous calyx lobes. Because of the unusual and highly modified nature of the fruiting hypanthium in the last two named species it is thought that *M. crassisepala* is probably more close-

ly related to the Cuban *M. emarginata* than to either of the others.

The differences in the shape of the fruiting hypanthium are illustrated in Figure 1G–N. In *Mouriri helleri* the hypanthium remains almost entirely above the fruit tissue, and the tendency for the base of the hypanthium to be expanded during fruit formation varies from none to slight. In *M. spathulata* the base of the hypanthium has become sunken in the fruit, but there is little or no tendency for it to be expanded. In *M. emarginata* and *M. crassisepala* the base is sunken and has been expanded, substantially so in the former, more so in the latter, while the apex remains unchanged in diameter or is compressed inward, producing an overhang of the hypanthium walls. In the last two species the apex of the fruit within the hypanthium is strongly convex in one-seeded fruits; in *M. crassisepala* the apex becomes flatter or very slightly concave, and the overhang less when there are more than one seeds and thus the diameter of the fruit is greater and the expansion of the apex of the fruit is increased. I have seen no fruits of *M. emarginata* with more than one seed. It would appear that the development of the forms with sunken hypanthia was associated with increased fruit size.

Paratypes. DOMINICAN REPUBLIC. **La Vega:** Jimenoa, mountains above (SW of) Jarabacoa, NW slope of the Loma La Sal, moist montane forest, 1,330 m, 21 May 1986, *W. S. Judd 5150* with *T. A. Zanoni, M. Mejia, J. D. Skean, Jr. & R. Beaman* (FLAS, JBSD); Cordillera Central, NW foothills of Loma de la Sal, disturbed cloud forest with *Brunellia, Baccharis, Miconia, Rhytidophyllum, Cyathea,* and *Arthrostylidium,* 1,330 m, 21 May 1986, *J. D. Skean, Jr. 1779* with *Beaman, Judd & Zanoni et al.* (FLAS, JBSD).

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Two New Combinations in *Triantha* (Liliaceae)

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ABSTRACT. Two new combinations at the subspecies level are proposed for *Triantha occidentalis* (S. Watson) Gates. A brief explanation is provided to account for their being made under this species name and not the presently more widely recognized *Tofieldia occidentalis* S. Watson.

In preparing the treatment of *Tofieldia* for the *Flora of North America* (FNA), I became aware that it is a rather heterogeneous assemblage, represented by two disparate sets of species. One is a homogeneous group of three species, *Tofieldia glutinosa* (Michaux) Persoon, *T. occidentalis* S. Watson, and *T. racemosa* (Walter) Britton, Sterns & Poggenberg, characterized by glandular pubescence, appendaged seeds, and clustered flowers. The other, consisting of *T. coccinea* Richardson, *T. glabra* Nuttall, and *T. pusilla* (Michaux) Persoon, is a much less homogeneous group whose members are glabrous, with appendageless seeds and flowers arising singly. In two of only three previous studies that include all the known North American species of *Tofieldia* (Baker, 1879; Gates, 1918), the former group of species was treated as a distinct genus, *Triantha*, based on a section of *Tofieldia* recognized by Nuttall (1818). Despite this, authors have consistently disregarded *Triantha*, the only significant exception being Small (1903).

In the broader context of the tribe Tofieldieae, a study by Ambrose (1980) showed that the monotypic *Pleea* (transferred by Utech (1978) to *Tofieldia*) was best treated as a separate genus, and Cruden (1991) came to a similar conclusion with respect to *Isidrogalvia*, traditionally included in *Tofieldia*. Both studies provided evidence that *Triantha* is distinct from *Tofieldia*. Clearly, systematic consistency would best be served if *Tofieldia* and *Triantha* were treated as separate genera following Baker (1879) and Gates (1918). R. Kiger (FNA taxon editor for Liliaceae) and F. Utech (FNA advisor on Liliaceae) have concurred.

In the following consideration of the necessity for the new combinations, for expository ease, the context of the discussion is that of the original genus *Tofieldia*. Hitchcock (1944), in his study of variation in *Tofieldia glutinosa* (= *Triantha glutinosa* (Michaux) Baker) and *Tofieldia occidentalis* (= *Triantha occidentalis* (S. Watson) Gates), identified, on the basis of morphological characters, "five fairly well marked . . . closely related entities . . . each of which has a rather well defined geographic range." He discussed the various ways in which they might be treated taxonomically, suggesting three possibilities:

1. Recognize all the entities as species;
2. Recognize two species, *Tofieldia glutinosa* and *Tofieldia occidentalis*, the former comprising two subspecies, the latter three;
3. Assign the five entities the rank of subspecies under a single species.

Hitchcock chose the third alternative and treated the five entities as subspecies of *Tofieldia glutinosa: occidentalis*, *brevistyla*, *absona*, *montana*, and *typica* (*glutinosa*). In discussing his second possibility, Hitchcock suggested that *montana* would be treated as a subspecies of *T. glutinosa*, while *brevistyla* and *absona* (which he said was only a local variant of *brevistyla*) would be treated under *T. occidentalis*.

In preparing the account of *Tofieldia* I examined most of the material that Hitchcock worked with as well as a considerable amount of additional material collected over the past 50 years, particularly from western Canada and Alaska. The investigation has confirmed Hitchcock's findings. The only minor exception is his *absona* (restricted to the Priest Lake area of Idaho), which is in my view not significantly different from *brevistyla* and is included with it. However, as a somewhat better understanding of the morphology of Hitchcock's subspecies emerged, it became apparent that the best taxonomic treatment was not the one that he finally selected but his second alternative, the recognition of two species, *Tofieldia glutinosa* and *T. occidentalis*, but with the difference that *montana* be treated as a subspecies of *T. occidentalis* along with *brevistyla* (including *absona*) and not as a subspecies of *T. glutinosa*.

When Watson (1879) described *Tofieldia occidentalis* he mentioned the occurrence of a "loose white spongy testa" surrounding the mature seeds, which is absent in *T. glutinosa*. The precise nature of this spongy or inflated enveloping tissue is not

certain—it may or may not be testa—but it instantly distinguishes *T. occidentalis* from *T. glutinosa* (and from the other trianthoid species, *T. racemosa* and *T. japonica*). The seeds of subspecies *brevistyla* and *montana* have the spongy covering, those of the former being identical to *T. occidentalis* in that the covering is strongly inflated, while in *montana* it is less strongly inflated.

Hitchcock appreciated the significance of this unique seed characteristic, making reference to it in discussing his second taxonomic scheme, when proposing that *brevistyla* and *absona* might be treated under *Tofieldia occidentalis*. It is consequently not clear why he should have been inclined to refer *montana* to *T. glutinosa*, especially since he remarked that the inflated testa of this subspecies is "a characteristic unlike *glutinosa*, but like *occidentalis*." He mentioned that the flowers of *T. glutinosa* and *montana* are similar, but the flowers in all the subspecies he distinguished are generally alike, and while they show some slight variation they are not of much significance in the recognition of infraspecific taxa.

Further to this, *montana* has, as Hitchcock observed, "much longer pubescence than is to be found in any other of the subspecies," and he said there is "no difficulty in distinguishing it from *glutinosa typica*." Although he did not mention it, the long cylindrical hairs below the inflorescence in *montana* occur to the complete exclusion of the dome-shaped or conical glands (Hitchcock's "haycocks") that are found to a greater or lesser extent in the other subspecies, and which in *T. glutinosa* are virtually the only vestiture on the stem. The more or less cylindrical hairs of various lengths, but longest in *montana*, are a characteristic of *T. occidentalis* and not of *T. glutinosa*. Watson (1879) had an insight into this difference when he described the pubescence of *T. occidentalis* as "viscid" and that of *T. glutinosa* as "glutinous."

Another character that Watson mentioned in distinguishing *Tofieldia occidentalis* from *T. glutinosa* is the division of the bracteoles, which he described as being "3-lobed nearly to the middle" in the former, and "scarcely lobed" in the latter. The variation in the lobing of the bracteoles in *T. occidentalis* is actually somewhat greater than originally indicated by Watson, and bracteoles of *T. glutinosa* may occasionally be deeply divided, but the difference Watson noted is valid and applies as well to the subspecies that Hitchcock described. It has also been observed in the present study that the bracteoles in *T. occidentalis* are often glandular, but glandular bracteoles are virtually unknown in *T. glutinosa*.

In light of the above it is concluded that the best taxonomic treatment of the variation that Hitchcock documented is essentially his second alternative: that is, to recognize *Tofieldia occidentalis* and *T. glutinosa* as distinct species with *brevistyla* (including *absona*) and *montana* treated as components of *Tofieldia occidentalis*.

This requires the following nomenclatural revisions.

Triantha occidentalis (S. Watson) Gates subsp. **brevistyla** (Hitchcock) Packer, comb. nov. Basionym: *Tofieldia glutinosa* (Michaux) Persoon subsp. *brevistyla* Hitchcock, Amer. Midl. Naturalist 31: 495. 1944. TYPE: Canada. British Columbia: 32 mi. N of Golden, 11 July 1944, *Hitchcock & Martin 7638* (holotype, WTU).

Triantha occidentalis (S. Watson) Gates subsp. **montana** (Hitchcock) Packer, comb. nov. Basionym: *Tofieldia glutinosa* (Michaux) Persoon subsp. *montana* Hitchcock, Amer. Midl. Naturalist 31: 496. 1944. TYPE: U.S.A. Montana: Glacier National Park, Logan Pass, 18 Sep. 1937, *Barkley & Marsh 1731* (holotype, WTU).

Acknowledgments. I am indebted to R. Kiger and F. Utech for reviews of the manuscript and suggestions.

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Aphelandra espirito-santensis (Acanthaceae), a New Species from Espírito Santo, Brazil

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ABSTRACT. A new Brazilian species of the genus *Aphelandra* is described and illustrated. It is related to *Aphelandra ignea* but differs markedly from that taxon by its leaf blades and the ovate to spathulate bracts with 4–5 spines on the margin. *Aphelandra* is represented in Brazil by 28 species. They occur from the Floresta Amazônica to the Floresta Atlântica.

Aphelandra R. Brown is a morphologically diverse genus characterized by a lack of cystoliths, a corolla with a distinct upper lip, four monothecous stamens, and elongated, tricolporate pollen.

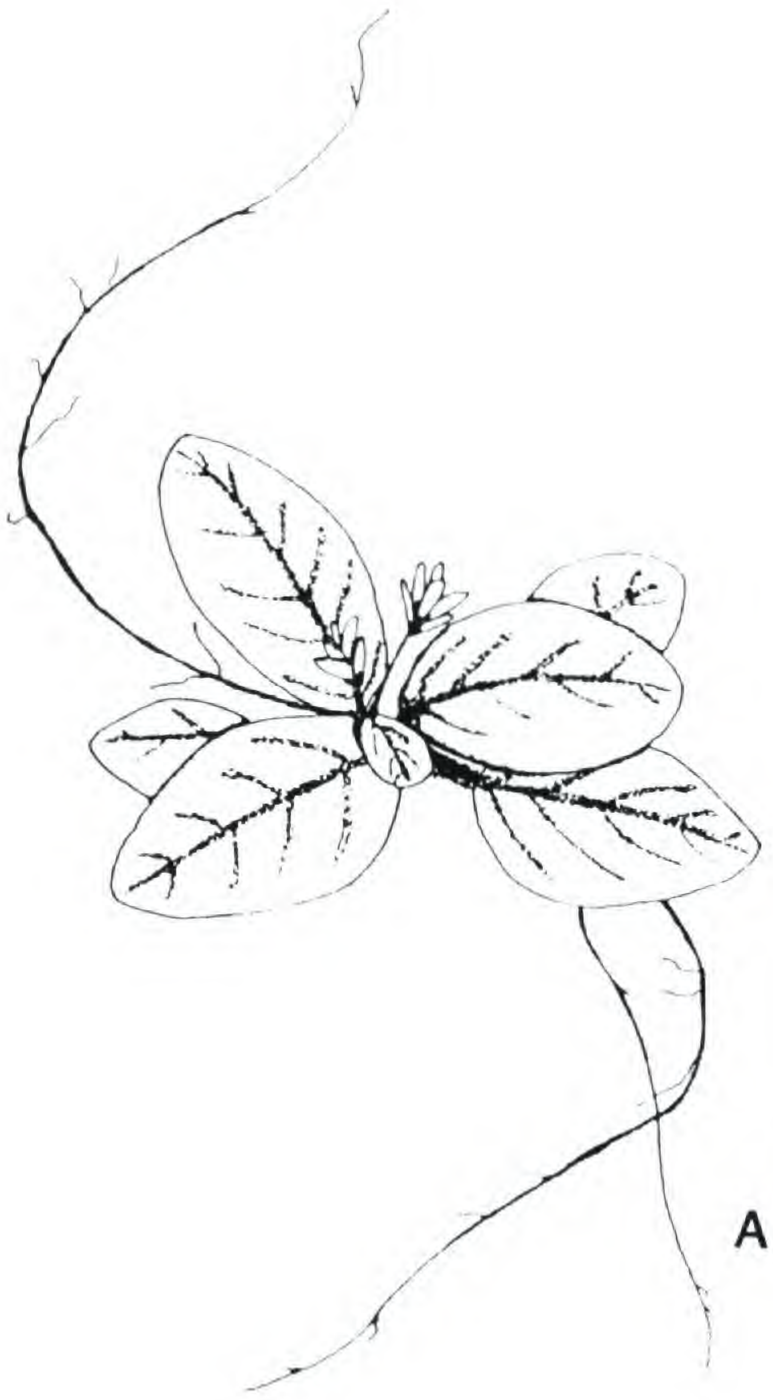
The result of a recently completed study of Acanthaceae specimens deposited in the Jardim Botânico do Rio de Janeiro (RB) has led to the discovery of an undescribed species.

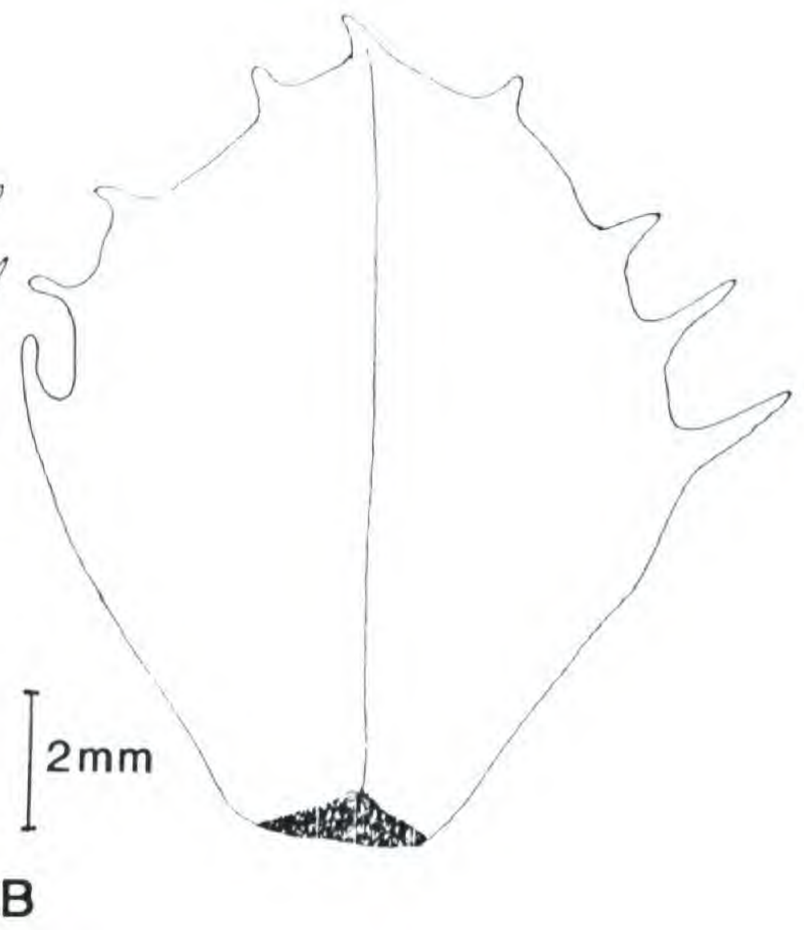
Aphelandra espirito-santensis Profice & Wasshausen, sp. nov. TYPE: Brazil. Espírito Santo: Mun. de Linhares, Reserva Florestal da Cia. Vale do Rio Doce, 26 Sep. 1978, *A. M. Carvalho et al. 80* (holotype, RB). Figure 1.

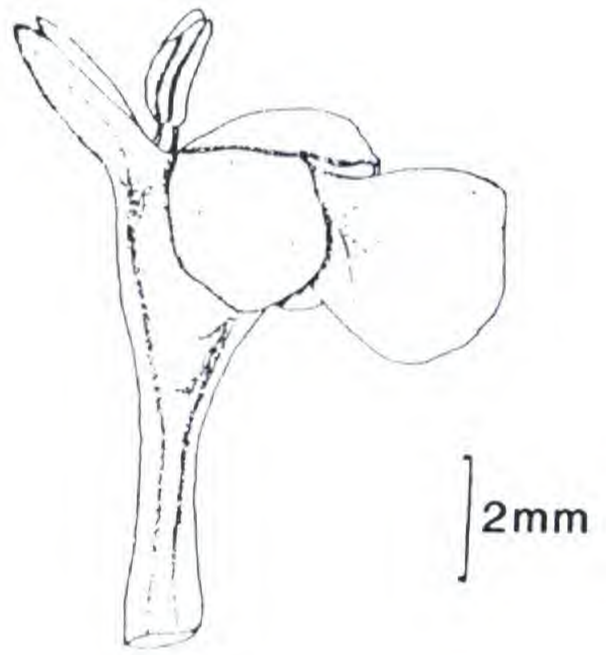
Herba, caulis reptans, subteres, pilis hirsutis, in apicem versum flavo-pubescens. Folia hirsuta, lamina ovata, basi apiceque obtusa, 3–6 paribus venis secundariis, 1.5–5 cm longa et 1.5–3 cm lata; petiolo 0.5–4 cm longo; inflorescentia spicata terminalis raro axillaris, 1.2–1.3 cm longa, rhachi flavo-pubescenti; bracteae imbricatae, obovatae vel spathulatae, marginibus 4–5 dentatis, extus pubescentes, membranaceae, 1–1.3 cm longae et 0.4–0.9 cm latae; bracteolae filiformes, apice aristatae, pilosae, striatae, subhyalinae, 5–6 mm longae et ca. 1 mm latae; calyx quinquepartitus, segmentis lanceolatis, subaequalibus, striatis, subhyalinis, aristatis, barbatis, 7–8 mm longis, 1–1.5 mm latis; corolla flava, ca. 1 cm longa, membranacea, pilosa, tubo cylindrico, basi aliquanto angustato 0.1 cm lato, fauci 0.2 cm lati, labio superiore bilobato, 0.3 cm longo et 0.2 cm lato, labio inferiore trilobato, lobis lateralibus obovatis, 0.3 cm longis et 0.2 cm latis, lobo medio orbiculato, 0.4 cm longo et 0.4 cm lato; stamina exserta, antheris ad apicem pilosis, ca. 2 mm longis; capsula ovata, glabra, 0.9–1 cm longa; semina ovata, brunnea, tuberculata, 2.5–3 mm longa et ca. 2 mm lata.

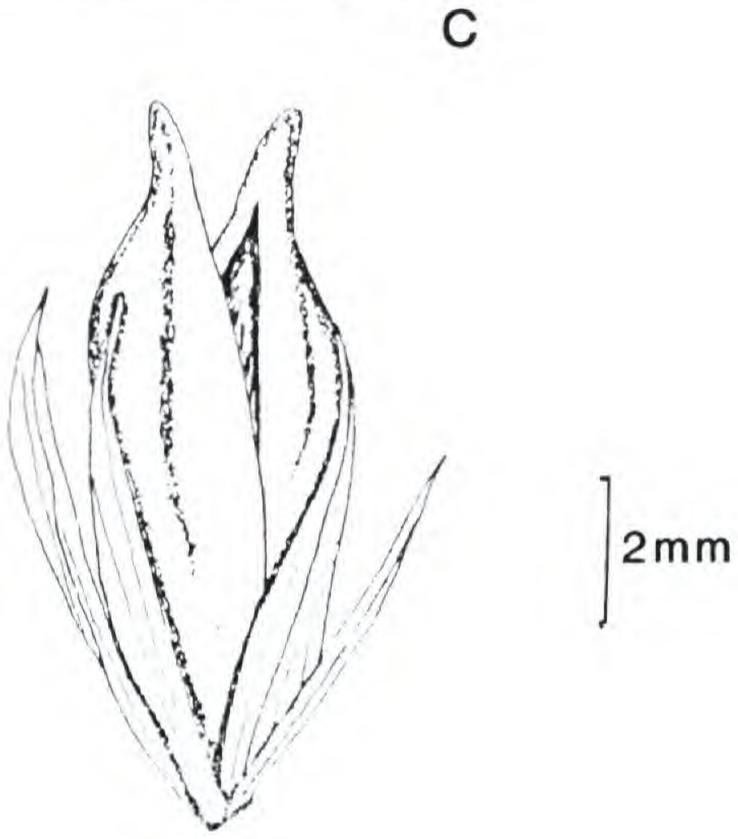
Herb; stem reptant at base, subcylindrical, with hirsute pubescence, the trichomes yellowish apically. Leaves with petioles 0.5–4 cm long, the pubescence similar to that of the stem, the blades ovate, obtuse apically and basally, with 3–6 pairs of secondary veins, hirsute on both the upper and lower surface, especially the veins and the margins, 1.5–5 cm long and 1.5–3 cm wide. Flowers borne in terminal, rarely axillary spikes 1.2–3 cm long, the rachis yellowish pubescent; bracts imbricate, obovate to spathulate, the margins spinulose-serrate, provided with 4–5 pairs of teeth, pubescent without, membranous, 1–1.3 cm long and 0.4–0.9 cm wide; bracteoles filiform, aristate at apex, pilose, striate-nerved, subhyaline, 5–6 mm long and 1 mm wide; calyx 5-parted, the segments lanceolate, subequal, striate-nerved, subhyaline, aristate, barbate, 7–8 mm long, the posterior segment ca. 1.5 mm wide, the anterior and lateral pair ca. 1 mm wide; corolla yellow, about 1 cm long, membranous, sparingly pilose, the tube cylindrical, 1 mm wide at base, about 2 mm wide apically, the upper lip bilobed, 3 mm long and 2 mm wide, the lower lip 3-lobed, the lateral lobes 3 mm long and 2 mm wide, the middle lobe orbicular, 4 mm long and wide; stamens exserted, anthers ca. 2 mm long, apically pilose; pollen prolate, tricolpate with the colpi extending from the equator nearly to one or both poles, 55–64 μm long and ca. 29 μm wide, the exine sculpturing verruculose (Fig. 2). Capsule ovate, glabrous, 9–10 mm long; seeds ovate, brown, tuberculate, 2.5–3 mm long and ca. 2 mm wide.

Distribution. Occurring in lowland forests in northern Espírito Santo at elevations of about 30 m.









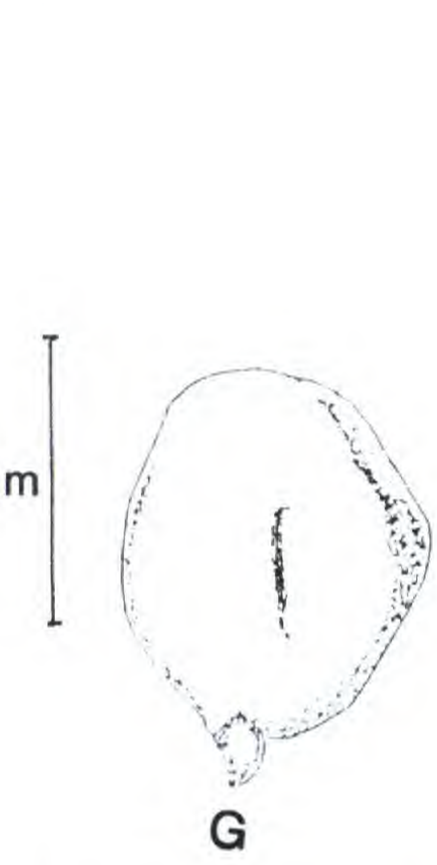


Figure 1. A–G. *Aphelandra espirito-santensis* Profice & Wasshausen (*Carvalho et al. 80*). —A. Habit. —B. Variability of the bracts. —C. Detail of the bract margin. —D. Corolla, stamens. —E. Calyx segments and capsule. —F. Seed. —G. Embryo. (Drawn by S. Profice.)

Figure 2. Scanning electron (SEM) photomicrographs of *Aphelandra espirito-santensis* pollen. —A. Equatorial view, ×1500 (*Carvalho et al. 80*). —B. Equatorial view, ×1400 (*Carvalho et al. 80*).

Aphelandra espirito-santensis shares diagnostic characteristics and affinities with two Brazilian species, *A. ignea* (Schrader) Nees ex Steudel and *A. phrynioides* Lindau. It is distinguished from *A. ignea* by its leaf shape and the ovate to spathulate floral bracts with 4–5 pairs of marginal teeth. From *A. phrynioides* the new taxon is distinctive by its much reduced corolla size and shape, leaf shape and size, and the size and shape of its floral bracts.

Using the infrageneric classification provided by Wasshausen (1975), *A. espirito-santensis* is included in the group of Brazilian species that are characterized by having entire or undulate leaf blades and floral bracts without bracteal nectaries and with marginal teeth. The following key may be used to distinguish the species of this group.

1. Corollas 7–25 mm long 2
1. Corollas 30–65 mm long 6
2(1). Corollas 10–13 mm long 3
2. Corollas 20–22 mm long 5
3(2). Bracts ovate, 17–20 mm long ..... *A. caput-medusae* Lindau
3. Bracts obovate to obovate-cuneate to spathulate, 9–13 mm long 4
4(3). Corollas red; bracts obovate-cuneate, 9 × 4 mm; leaf blades oblong-oval 8–10 cm long ..... *A. decorata* (Nees) Wasshausen
4. Corollas yellow; bracts obovate to spathulate, 10—13 mm long; leaf blades ovate, 1.5–5 cm long ..... *A. espirito-santensis* Profice & Wasshausen
5(2). Leaf blades ovate, 8–12 × 4–6.5 cm; bracts obovate, 17–19 × 14 mm, mucronulate at apex; corolla sparingly glandular-pilose ..... *A. neesiana* Wasshausen
5. Leaf blades oblong-elliptic to oblong-lanceolate, 8–9 × 2.5–3.5 cm; bracts elliptic-oblong, 13–15 × 5–6 mm, obtuse at apex; corolla glabrous ..... *A. bahiensis* (Nees) Wasshausen
6(1). Corollas yellow 7
6. Corollas red, orange, or scarlet 9
7(6). Bracts conduplicate ..... *A. ornata* (Nees) T. Anderson
7. Bracts plane, not folded or conduplicate 8
8(7). Corollas ca. 40 mm long, the upper lip obovate, 8 × 7 mm, bilobed ..... *A. phrynioides* Lindau
8. Corollas 30 mm long, the upper lip oval, 5 × 5 mm, entire ..... *A. ignea* (Schrader) Nees ex Steudel
9(6). Leaf blades narrowly elliptic, 2–3.2 cm wide, acuminate at apex; bracts oblong to elliptic,

18 × 6 mm, green with the upper margins purplish, the margins spirulose-dentate with about 5 pairs of teeth; corolla orange ..... *A. margaritae* E. Morren

9. Leaf blades narrowly ovate, 4–5 cm wide, acute to obtuse at apex; bracts obovate, to 18 × 14 mm, purplish, the margins spinulose-serrate with about 7 pairs of teeth; corolla red ..... *A. obtusifolia* (Nees) Wasshausen

Should one wish to compare the new taxon to some of the smaller terrestrial herbs of *Aphelandra* of Central America, e.g., *A. seibertii* Leonard or *A. tonduzii* Leonard, the following key will demonstrate the major differences.

1. Floral bracts narrowly lanceolate, 1.5 mm wide, with 1 pair of minute, slender marginal teeth; corollas pale pink. Costa Rica ..... *A. tonduzii* Leonard

1. Floral bracts obovate to spathulate, 4–9 mm wide, with 2–5 pairs of conspicuous marginal teeth; corollas yellow 2

2. Corollas 20 mm long; leaf blades oblong-elliptic, thinly pilose; flowers borne in spikes 4–8 cm long; bracts bearing 2 or usually 3 marginal teeth. Costa Rica and Panama ..... *A. seibertii* Leonard

2. Corollas 10 mm long; leaf blades ovate, hirsute; flowers borne in spikes 1.2–3 cm long; bracts bearing 4–5 pairs of marginal teeth. Brazil ..... *A. espirito-santensis* Profice & Wasshausen

Paratypes. BRAZIL. **Espírito Santo:** Mun. de Linhares, Reserva Florestal da Cia. Vale do Rio Doce, *G. Martinelli 4993* (RB); Reserva de Sooretama, *D. Sucre 5701* (RB); Reserva de Sooretama, *G. Martinelli 2285* (RB).

Acknowledgment. Our special thanks to Jorge Fontella Pereira for the revision of the Latin diagnosis.

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New Species of *Pentacalia* (Senecioneae: Asteraceae) from Ecuador, Peru, and Bolivia

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ABSTRACT. Twelve new species of *Pentacalia* are described from Ecuador: *P. carmelana*, *P. cazaletii*, *P. dodsonii*, *P. dorrii*, *P. hurtadoi*, *P. luteynorum*, *P. moronensis*, *P. napoensis*, *P. pailasensis*, *P. palaciosii*, *P. zakii*, *P. zamorana*; nine new species are described from Peru: *P. balsasana*, *P. cutervonis*, *P. davidsmithii*, *P. maynasensis*, *P. mucronatifolia*, *P. nunezii*, *P. sagasteguii*, *P. tillettii*, and *P. todziae*; and two new species are described from Bolivia: *P. inquisiviensis* and *P. lewisii*. *Gynoxys vargasiana* Cabrera of Peru is transferred to *Pentacalia*. Keys are provided for the species of *Pentacalia* subg. *Pentacalia* in Ecuador and Peru.

Over a period of years since the resurrection of the genus *Pentacalia* Cassini (Robinson & Cuatrecasas, 1978; Cuatrecasas, 1981; Robinson in Proctor, 1982), a number of undescribed species, mostly of the subgenus *Pentacalia*, have been set aside awaiting review. Progress on a study of *Pentacalia* in Colombia by Diaz-Piedrahita and Cuatrecasas (in prep.) has furnished a basis for comparison with unidentified specimens. The opportunity has been taken to describe twelve new Ecuadorian species, nine new Peruvian species, and two new Bolivian species. The large number of undescribed species is one indication of the generally inadequate treatment of Asteraceae of the tropical forests.

As seen in Cuatrecasas (1981), there have been 13 species of subgenus *Pentacalia* claimed from Ecuador, to which should be added *P. floribunda*, which was listed under subgenus *Microchaete*. In addition to the new species, in our review of *Pentacalia* subg. *Pentacalia* in Ecuador we have encountered recent collections of some other rarely collected Ecuadorian species: *P. andrei* (Greenman) J. Cuatrecasas, Zamora–Chinchipe, limit of Parque Nacional Podocarpus, around pass on road Loja–Zamora, alt. 2,750–2,950 m, 25 Dec. 1988, *Madsen & Ellemann 75982* (AAU, QCA, US). *Pentacalia corazonensis* (Hieronymus) J. Cuatrecasas, Cotopaxi: Quevedo–Latacunga road, Páramos de Zumbagua, 19 km E of Pilaló and 78 km W of Latacunga, elev. 3,536 m, 25 Dec. 1978, *Luteyn & Luteyn 6510* (NY, MO); Loja: road to Zamora from Loja, km 12–14, near top of pass, elev. 2,800 m, 28 Sep. 1961, *Dodson & Thien 779* (US). *Pentacalia lanceolifolia* (J. Cuatrecasas) J. Cuatrecasas, Loja: Parque Nacional Podocarpus, Cerro Toledo, 2,500–3,400 m, 30–31 Oct. 1989, *Madsen 86250* (AAU, QCA, US). *Pentacalia millei* (Greenman) J. Cuatrecasas, Loja: Parque Nacional Podocarpus, 2,750–2,850 m, 4 May 1984, *Øllgaard, Madsen & Christensen 74195* (AAU, QCA, US); Loja: Parque Nacional Podocarpus, E of Nudo de Cajanuma, trail E of "Centro de Informacion" to crest on trail to Laguna de Compadre, 2,850–3,050 m, 7 June 1988, *Øllgaard 74631* (AAU, QCA); Parque Nacional Podocarpus, new road Loja–Zamora, E of Cerro Yanococha, along former Indian trail to Zamora, 2,550–2,650 m, 26 Nov. 1988, *Madsen 75586* (AAU, QCA); Parque Nacional Podocarpus, road Yangana–Valladolid, km 21, alt. 2,700 m, 10 Nov. 1989, *Madsen 86403* (AAU, QCA). *Pentacalia sevillana* (J. Cuatrecasas) J. Cuatrecasas, Loja: 7 km N of San Lucas on road to Loja, elev. 8,800 ft., 27 Jan. 1979, *R. M. King & F. Almeda 7841* (US).

Cuatrecasas (1981) listed 20 members of *Pentacalia* subg. *Pentacalia* in Peru. Nineteen of these species are treated by Cabrera (1954) in the key to scandent *Senecio* species of Peru and Bolivia. Nine new Peruvian species of *Pentacalia* subg. *Pentacalia* are described here, and a new key is provided. In addition, the primarily Ecuadorian *P. disciformis* (Hieronymus) J. Cuatrecasas has been seen from northern Peru: Piura, Cerro Aypate, 49 km E of Ayabaca, 2,750 m, 22 Sep. 1991, *Gentry, Diaz & Ortiz 7471* (MO, US).

The species occurring in Bolivia are also treated in the key by Cabrera (1985). Eighteen species were included, many of which also occur in Peru. Two new Bolivian species are described here with reference to their placement in the Cabrera key.

In the following descriptions the height of the heads is measured from the top of the peduncle to the tips of the disk corollas.

A New Species of *Pentacalia* (subg. *Microchaete*) in Ecuador

Pentacalia (subg. *Microchaete*) **dodsonii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Zamora: road from Loja to Zamora, elev. 2,800 m, 18 Sep. 1961, *Dodson & Thien 676* (holotype, SEL).

P. onae et *P. scitophyllae* simila sed in bracteis involucri paucioribus distincta.

Shrub 0.7–1.7 m high, moderately branched; stems dark brown, densely pilose with stout, blunt hairs or nearly glabrous; internodes ca. 1 cm long; pith solid. Leaves alternate; petioles 0.5–1.0 cm long, with few to many short, stout hairs; blades oblong-elliptical, mostly 6–7 cm long, 1.6–3.0 cm wide, base short-acute, margins closely serrate, apex shortly and sometimes narrowly acuminate, both surfaces with network of veinlets raised slightly above surface, irregularly pilose to nearly glabrous, lower surface paler green, with 7 or 8 prominent, strongly ascending secondary veins on each side. Inflorescences terminal on leafy branches, broadly corymbose with numerous branches; peduncles 1.2–2.5 cm long, usually with numerous narrowly subulate bracteoles 2–3 mm long, with 2–4 bracteoles forming calyculus. Heads heterogamous, radiate, 9–10 mm high; involucral bracts 8, broadly oblong, 4–5 mm long, ca. 2 mm wide, apex obtuse to short-acute, glabrous; rays 8, corollas yellow, glabrous, basal tube ca. 4.5 mm long, limb large, ca. 10 mm long, 3.5 mm wide. Disk florets ca. 17; corollas ca. 6.5 mm long, basal tube ca. 2 mm long, throat ca. 2.5 mm long, lobes ca. 1 mm long, 0.7–0.9 mm wide at base, tips slightly thickened with sclerified shield of many slightly bulging, moderately enlarged cells outside; anther thecae ca. 2 mm long, very shortly pointed at base; backs of style branches with papillae continuing onto upper shaft of style. Achenes ca. 3 mm long, glabrous; pappus bristles mostly ca. 5 mm long with broadened tips of somewhat enlarged fusiform cells. Pollen grains ca. 35 μm diam.

The new species resembles the closely related *Pentacalia onae* (J. Cuatrecasas) J. Cuatrecasas and *P. scitophylla* (HBK) J. Cuatrecasas in general aspect but differs most obviously in having only ca. 8 bracts in the involucre instead of ca. 13. The backs of the style branches have papillae along their entire length and onto the upper part of the style shaft. The latter papillae are presumably like those of other species of *Pentacalia* subg. *Microchaete*, but they are unlike any *Pentacalia* subg. *Pentacalia* described below. None of the following species have papillae on the backs of the style branches continued to the base.

Paratypes. ECUADOR. **Loja:** road to Zamora from Loja, km 12–14, elev. 2,800 m, near top of pass, shrub 4–5 ft. high, 28 Sep. 1961, *Dodson & Thien 778* (SEL). **Loja/Zamora–Chinchipe:** limit of Parque Nacional Podocarpus, around pass on road Loja–Zamora, wet elfin forest, scrub-paramo and treeless ridgetop vegetation, 79°07′W, 03°58′S, 2,900 m, 8 Jan. 1989, shrub, *Madsen 85480* (AAU).

New Species of *Pentacalia* (subg. *Pentacalia*) in Ecuador

Pentacalia (subg. *Pentacalia*) **carmelana** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Napo: Cartagena, km 25 from El Carmelo on road toward La Bonita, 77°30′W, 0°37′N, alt. ca. 2,800 m, 13 Apr. 1979, *Løjtnant, Molau & Madison 12335* (holotype, AAU).

In foliis late ovatis sparse vel distincte crispe hirtellis in capitulis radiatis et in floribus staminodeiferis distincta.

Plants scandent, indefinitely elongate; stems densely hirtellous with short brownish hairs, not or weakly fistulose. Leaves alternate, petioles 1.2–1.7 cm long, stout, densely hirtellous with stout hairs; blade thinly coriaceous, broadly oblong-ovate, ca. 9 cm long, ca. 6.5 cm wide, base broadly rounded, margins entire, slightly reflexed, apex rounded with minute apiculus, upper surface nearly smooth, slightly shiny, with few hairs mostly on veins, lower surface with numerous short crisped hairs on veins, with sparse hairs between veins; secondary veins prominent, 4 or 5 on each side, spreading at ca. 50°, arching, veinlets scarcely raised above surface. Inflorescences mostly lateral from axils of vegetative leaves, ca. twice as long as leaves, with foliose bracts in basal half, blades to 3.5 cm long, ca. 2.5 cm wide; distally a rounded or pyramidally thyrsoid panicle, with branches corymbose; peduncles 3–7 mm long, densely puberulous. Heads 9–10 mm high, heterogamous, radiate; subinvolucral and calycular bracts minute, subulate, mostly 1.5 mm long, with few minute hairs; involucral bracts ca. 8, glabrous, ca. 6 mm long, 1.5 mm wide, apices short-acute. Ray florets ca. 6; corollas yellow, glabrous, tube 5–6 mm long, limb ca. 5 mm long, usually with 2 minute staminodia. Disk florets 15–18; corollas yellow, glabrous, tube ca. 4 mm long, throat ca. 2 mm long, lobes ca. 2 mm long, 0.55 mm wide, moderately thickened at tip with sclerified shield of many enlarged, bulging cells outside; anther thecae ca. 1.5 mm long, basal tails nearly as long as collar; apical appendage oblong, ca. 0.3 mm long, 0.15

mm wide. Achenes ca. 2 mm long, 5-ribbed, glabrous; pappus bristles 5–6 mm long, tips not broadened, often nearly smooth. Pollen grains ca. 30 μm diam.

The single known specimen is cited from a dense, mossy cloud forest. In Ecuador the species seems most similar to other radiate species with lateral inflorescences, *P. huilensis* and *P. riotintis*, but the latter are more glabrous and lack the large foliose bracts on the bases of their inflorescences.

Pentacalia (subg. *Pentacalia*) **cazaletii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Pichincha: 20 km W of Santo Domingo de los Colorados, alt. 1,000 ft., 18 Oct. 1961, *Cazalet & Pennington 5064* (holotype, US; isotypes, B, K, NY).

In nervis secundariis foliorum obscuris in inflorescentibus axillaribus thyrsoideis bracteiferis et in capitulis heterogamis disciformis distincta.

Plants scandent, indefinitely elongate; stems glabrous or glabrescent, with solid pith. Leaves alternate, petioles 0.7–1.1 cm long; blade fleshy, drying thinly subcoriaceous, ovate-elliptical, 8–10 cm long, 3.0–4.2 cm wide, base and apex short-acute, margins entire, upper and lower surfaces glabrous and smooth, only midvein prominent below, secondary veins 5–6 on each side, ascending and arching, obscure. Inflorescences lateral from axils of vegetative leaves, one and a half to three times as long as leaves, pyramidally thyrsoid, bracts foliiform, oblong-elliptical, mostly 2–5 cm long, 0.8–2.0 cm wide, apices obtuse with slight mucro; branches spreading at about 45°; peduncles 0–4 mm long, sparsely tomentellous. Heads ca. 8 mm high, heterogamous, disciform; subinvolucral and calycular bracteoles ca. 7, subulate, ca. 2.5 mm long, ca. 0.8 mm wide; involucral bracts 8, ca. 6 mm long, ca. 1 mm wide, apices acute, glabrous. Female florets 4, tubular; corollas yellow, glabrous, 5.0–5.5 mm long, tube ca. 3.5 mm long, lobes linear, ca. 1.8 mm long. Disk florets 8 or 9; corollas yellow, glabrous, 6.0–6.5 mm long, tube ca. 3 mm long, throat ca. 1.8 mm long, lobes narrowly oblong, 1.5–1.8 mm long, 0.40–0.45 mm wide, tips minimally thickened with subsclerified shield of large, somewhat bulging cells outside; anther thecae ca. 1.5 mm long, basal tails ca. two-thirds as long as collar; apical appendage oblong, ca. 0.3 mm long, 0.12–0.15 mm wide. Achenes ca. 1.5 mm long, glabrous; pappus bristles ca. 7 mm long, with apical cells not or scarcely broadened. Pollen grains ca. 27 μm diam.

The holotype is cited from a seasonal rainforest, as an "epiphyte on a dead 50 ft. tree." The paratype is cited from "Bosque muy húmedo Montano Bajo." The fleshy, glabrous, elliptical leaves can be distinguished from many species of *Pentacalia* by the obscurity of the upwardly ascending secondary veins. The elongate, thyrsoid, bractiferous lateral inflorescences and the small heads bearing disciform rays are distinctive. The species is evidently restricted to the western side of the Andes.

Paratype. ECUADOR. **Pichincha:** Quito Canton, Chiriboga, en la carretera vieja a Santo Domingo, Reserva Forestal "La Favorita" del Minsterio Agric., 78°47′W, 00°12′S, 1,600–1,800 m, 8 Mar. 1990, *Cerón, Ayala & Jimenez 8937* (MO, US).

Pentacalia (subg. *Pentacalia*) **dorrii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Loja: road to Fierro Acru, N of Pichig (ca. 3°40′S, 79°15′W), 3,015–3,385 m, 15 July 1989, *Dorr & Valdespino 6654* (holotype, US; isotype, NY).

In foliis obovatis base cuneatis in nervis secundariis ascendentibus in inflorescentiis terminalibus et capitulis radiatis distincta.

Scandent shrubs; stems glabrous, scarcely striate, partially fistulose. Leaves alternate, petioles 1.0–1.5 cm long, moderately swollen at base; blades thinly subcoriaceous, glabrous, obovate, broadest in distal third or fourth, 5.0–7.5 cm long, 1.5–2.5 cm wide, base narrowly cuneate, margins entire, apex obtuse to short-acute with small apiculus, surfaces with secondary veins slightly raised above surface and less strongly raised veinlets; secondary veins ca. 5 on each side, strongly ascending at 30–35°, somewhat indistinct from reticulum of veinlets forming elongated areoles. Inflorescences terminal, broadly corymbose, with stem slightly inflated in lower part, only lowest branches from axils of reduced leaves, bracts above base small, subulate; peduncles 3–8 mm long, minutely puberulous. Heads 10–12 mm high, heterogamous, radiate; subinvolucral and 4 or 5 calycular bracts subulate, glabrous, to 1.5 mm long; involucral bracts ca. 8, glabrous, ca. 7 mm long, 1.5 mm wide, apices short-acute. Ray florets 5; corollas yellow, glabrous, tube ca. 5 mm long, limb 8–9 mm long. Disk florets ca. 9; corollas yellow, ca. 10 mm long, tube ca. 3 mm long, throat ca. 5 mm long, lobes ca. 1.5 mm long, 0.8 mm wide, lobes thickened equally to tip, tip with sclerified shield of scarcely bulging cells outside; anther thecae ca. 2.8 mm long, basal tails often longer than collar, apical appendage narrowly oblong, ca. 0.6 mm long, 0.3 mm wide. Achenes submature, ca. 2 mm long, glabrous, weakly 5-ribbed;

pappus bristles 7–8 mm long, slightly but distinctly broader and more roughened at tips. Pollen ca. 35 μm diam.

The new species has the general appearance of many of the glabrous, fleshy-leaved members of *Pentacalia*, but it is distinctive in the strongly obovate leaf blades with strongly ascending secondary veins. Its closest relation may be to *P. corazonensis*, an Ecuadorian species with similar terminal inflorescences and radiate heads. The latter has leaves that are distinctive in their oblong shape and rounded apices. The veins of the latter are more prominent in all the specimens seen. The slight enlargement of the stem in the base of the inflorescence is reminiscent of the condition in *P. luteynorum* described below, but the latter has obscure secondary veins in the leaves and smaller heads with whitish rays. As noted on the specimen by Pruski, there is a close match with a type photograph of *Senecio willdenowii* Schultz Bip. in Berlin, which differs only in less blunt leaf apices. The latter name has never been validly published.

Pentacalia (subg. *Pentacalia*) **hurtadoi** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Napo: 3 km este del Caserío de Huamaní, al norte de la carretera Hollín–Loreta, por una trocha, 00°43′S, 77°36′W, 1,200 m, 17 Sep. 1988, *Hurtado & Alvarado 302* (holotype, US; isotype, MO).

In foliis glabris in nervis secundariis pinnatis prominentibus arcuatis in inflorescentiis axillaribus plerumque racemiformis et in capitulis homogamis distincta.

Plants scandent, indefinitely elongate; stems glabrous, with solid pith. Leaves alternate, petioles 1.2–1.7 cm long; blades subcoriaceous, glabrous, ovate-elliptical to elliptical, 10–12 cm long, 3.5–4.5 cm wide, base short-acute, margins entire, apex apiculate, upper surface nearly smooth, on each side with ca. 6 arching secondary veins prominent on lower surface, intervening veins sometimes rather prominent. Inflorescences lateral, from axils of vegetative leaves, usually somewhat shorter than leaves, cylindrical, mostly racemiform, thyrsoid at base; peduncles 3–7 mm long, finely puberulous. Heads 10–11 mm high, homogamous; calycular bracts ca. 4, glabrous, 2–3 mm long, ca. 0.5 mm wide; involucral bracts ca. 8, glabrous, 7–8 mm long, 1.0–1.5 mm wide, apices short-acute. Ray florets lacking; disk florets ca. 15; corollas yellow, glabrous, ca. 8 mm long, tube ca. 4 mm long, throat ca. 2 mm long, lobe ca. 2 mm long and 0.6 mm wide, tips somewhat thickened with sclerified shield of large, slightly bulging cells outside; anther thecae ca. 2 mm long, with basal tails as long as collar; apical anther appendage narrowly oblong, ca. 0.4 mm long, ca. 0.12 mm wide. Achenes ca. 1.8 mm long, glabrous; pappus bristles ca. 7 mm long, not broadened at tips, without enlarged apical cells. Pollen grains ca. 30 μm diam.

The two available specimens of this species were obviously collected during the same trip to the Volcán Sumaco area. The habitats were given as primary and secondary forest, and humid or pluvial premontane forest.

The species is one of the few described here from Ecuador without either ligulate or disciform rays. The glabrous leaves with prominent, arching, secondary veins, and the short, lateral, mostly racemiform inflorescences are distinctive. A number of species with lateral inflorescences occur in Ecuador and Peru, but such species are rare in Colombia. One species in Colombia with lateral inflorescences, *P. uribei* J. Cuatrecasas, is very similar to *P. hurtadoi* in form of the leafy branches and the inflorescences with homogamous heads, but it has shorter involucral bracts and a mixed indument of erect pilosity with persistent bases and tenuous arachnoid hairs on the leaves (Cuatrecasas, 1985).

Paratype. ECUADOR. **Napo:** carretera Hollín–Loreto, 5 km al W de Guamaní, faldas del Volcán Sumaco, 00°43′S, 77°38′W, 1,200 m, 6–7 Sep. 1988, *Neill, Hurtado & Alvarado 8558* (MO, US).

Pentacalia (subg. *Pentacalia*) **luteynorum** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Napo–Pastaza: Baeza–Tena road, remnant forest patches and roadside slopes from Cosanga to 5 km S of Cosanga, 1,975–2,225 m, 9 Jan. 1979, *Luteyn & Lebrón-Luteyn 6733* (holotype, US; isotype, NY).

In foliis ellipticis glabris, in nervis secundariis obscuris in caulibus in partibus fertilibus inflatis in inflorescentiis terminalibus et in radiis elongatis albis distincta.

Scrambling subshrubs or vines 2 m high or longer; stems terete, finely puberulous, becoming glabrous and slightly but distinctly inflated near base of inflorescence, with solid pith. Leaves alternate, petioles 0.7–1.0 cm long; blades fleshy, drying thinly subcoriaceous, elliptical, 5.5–9.0 cm long, 2.0–3.7 cm wide, base short-acute, margins entire, apex short-acuminate, upper and lower surfaces glabrous, with only midvein prominent below; 5 or 6 obscure, upwardly directed, secondary veins on each side. Inflorescence terminal, broadly corymbose to broadly pyramidal; foliose primary bracts on broadened stem

below inflorescence and at lower branches of inflorescence, lower bracts with petioles to 0.5 cm long, upper bracts sessile; blades glabrous, oblong, 2–4 cm long, 0.4–1.7 cm wide, apically obtuse; lower branches long and unbranched basally, corymbose distally, distal branches with short unbranched basal parts; peduncles 3–8 mm long, finely puberulous. Heads 8–9 mm high, heterogamous, radiate; subinvolucral and calycular bracts 5–8, subulate, minute, 0.8–1.5 mm long, 0.5–1.0 mm wide; involucral bracts ca. 8, oblong, ca. 5 mm long, 1.0–1.3 mm wide, apices rounded or obtuse, very sparsely puberulous. Ray florets ca. 8; corollas white, glabrous, tube 3.0–3.5 mm long, limb 3.5–4.0 mm long, with 1 or 2 minute staminodia. Disk florets ca. 15; corollas yellow, tube ca. 2 mm long, throat ca. 2 mm long, lobes ca. 1.2 mm long, ca. 0.5 mm wide, tips somewhat thickened with sclerified shield of enlarged bulging cells outside; anther thecae ca. 1.3 mm long, basal tails half to two-thirds as long as collar, apical appendage narrowly oblong, ca. 0.25 mm long, 0.15 mm wide. Achenes submature, ca. 1 mm long, glabrous; pappus bristles 4.5–5.0 mm long, tips not or scarcely broadened. Pollen grains ca. 27 μm diam.

The paratype is cited from disturbed forest. The specimens of this species have been referred previously to cf. *Pentacalia jelskii* (Hieronymus) J. Cuatrecasas of Bolivia and southern Peru, which has an elongate inflorescence and disciform or very shortly radiate heads, and *P. huilensis* (J. Cuatrecasas) J. Cuatrecasas of Colombia, which has more prominent secondary leaf veins, a more condensed inflorescence, and yellow rays. The new species seems to have a number of distinctive features, including the somewhat swollen stem at the base of the inflorescence and the white rays with minute staminodia. The species is named after the collectors of the type.

Paratype. ECUADOR. **Napo:** Cantón Quijos, along camino from Cosanga to Río Aliso, ca. 5 km W of Cosanga, approx. 77°53′W, 0°30′S, 2,000 m, 20 Feb. 1978, *Kirkbride & Chamba 4255* (US).

Pentacalia (subg. *Pentacalia*) **moronensis** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Morona–Santiago: along new road Mendez–Morona, km 55–62, 800 m, 23 Aug. 1989, *van der Werff & Gudiño 11385* (holotype, US; isotype, MO).

In caulibus fistulosis in foliis carnosis glabris in inflorescentiis lateralibus elongatis racemoso-thyrsoideis et in capitulis homogamis distincta.

Plants scandent, indefinitely elongate; stems terete, rather straight, glabrous, fistulose. Leaves alternate, petioles 1.5–3.0 cm long; blades fleshy, drying coriaceous, oblong-elliptical, 12–16 cm long, 7.5–8.5 cm wide in type, 3.7–5.5 cm wide in paratypes, base shortly obtuse, short-acute in paratypes, margins entire, apex very short-acuminate, except at midvein surface smooth, glabrous, secondary veins obscure, ca. 5 on each side, spreading at ca. 45°. Inflorescences lateral, slightly longer than subtending leaves, narrowly racemiform-thyrsoid with many branches along entire length; bracteoles minute, linear, to 2 mm long; peduncles mostly 4–8 mm long, minutely puberulous. Heads 9–12 mm high, homogamous, with somewhat turbinate bases; calycular bracts 2 or 3, subulate, to 3.5 mm long, glabrous; involucral bracts usually 8, glabrous, 8–10 mm long, 1.5–2.0 mm wide, short-acute. Ray florets lacking; disk florets 15–23; corollas yellow, glabrous, 8–9 mm long, tube 3–4 mm long, throat ca. 3 mm long, lobes ca. 1.8 mm long and 0.6–0.7 mm wide, tips minimally thickened with sclerified shield of large, bulging cells outside; anther thecae ca. 2 mm long, basal tails three-fourths as long as collar; apical anther appendage ca. 0.45 mm long, 0.12 mm wide. Achenes immature, ca. 1 mm long, glabrous; pappus bristles 8–9 mm long, not broadened at tips in *11385*, broadened with short pointed cells in *4751* and *11260*. Pollen grains 35–37 μm diam.

The specimens of this species are cited from lomas, in humid, tropical, primary forest and forest remnants. The new species seems closest to *P. nigella* (Badillo) J. Cuatrecasas of Venezuela, which is similar in the straight, fistulose stems and homogamous heads, but which has a much less branched, racemiform and scarcely thyrsoid inflorescence. The heads of the new species have turbinate bases and the involucral bracts extend to the tips of the corollas, while the specimens seen of *P. nigella* have heads with rounded bases and corolla lobes distinctly exceeding the involucral bracts. The type specimen of the new species, *van der Werff & Gudiño 11385*, which has the most mature heads, is similar to *P. nigella* in the lack of enlarged tips on the pappus bristles, but the leaves are broadly oblong to 8.5 cm wide. The paratype specimens, which may prove varietally distinct, have leaf blades more narrowly oblong as in *P. nigella*, but have the tips of the pappus bristles enlarged with short, broad apical cells.

Paratypes. ECUADOR. **Morona–Santiago:** along road Mendez–Morona, km 30–35, 800 m, 19 Aug. 1989, *van der Werff & Gudiño 11260* (MO, US); pazo petrolero "Garza" de Tenneco, 35 km (aprox.) al noreste de Montalvo, 01°49′S, 76°42′W, 260 m, 2–12 jul. 1989, *Zak & Espinosa 4751* (MO, US).

Pentacalia (subg. *Pentacalia*) **napoensis** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Napo: 3 km este del Caserío de Huamní, al norte de la carretera Hollín–Loreto, por una trocha, 00°43′S, 77°36′W, 1,200 m, 17 Sep. 1988, *Hurtado & Alvarado 478* (holotype, US; isotype, MO).

In foliis glabris in nervis secondariis ascendentibus in nervis et nervulis supra et subtus distincte dense prominulis in inflorescentiis lateralibus et in capitulis homogamis distincta.

Plants scandent, indefinitely elongate; stems glabrous, narrowly fistulose. Leaves alternate, petioles 1.3–2.0 cm long; blades thinly coriaceous, glabrous, elliptical, 8–11 cm long, mostly 3.0–4.8 cm wide, base and apex shortly and narrowly acuminate, margins entire, upper and lower surfaces with veinlets closely and distinctly raised above surface; secondary veins ca. 6 on each side, spreading at 35–40°. Inflorescence lateral, from axils of vegetative leaves, one and a half to two times as long as leaves, unbranched in basal 6 cm, narrowly thyrsoid distally; peduncles mostly 5–10 mm long, finely puberulous, with few subulate bracteoles ca. 1.5 mm long. Heads 12–14 mm high, homogamous; calycular bracts 3 or 4, similar to bracteoles; involucral bracts ca. 8, glabrous, 9–10 mm long, 1.0–1.3 mm wide, apices short-acute. Ray florets lacking; disk florets 12–14; corollas yellow, glabrous, 10–11 mm long, tube 4.5–5.0 mm long, throat 2.0–2.5 mm long, lobes ca. 1.5 mm long, 0.5 mm wide, tips not thickened, with subsclerified shield of large, somewhat bulging cells outside; anther collars not or scarcely inflated below; anther thecae ca. 1.5 mm long, with basal tails three-fourths as long as collar; apical anther appendage narrowly oblong, ca. 0.45 mm long, 0.12 mm wide. Achenes ca. 2.3 mm long, glabrous, faintly 7- or 8-ribbed; pappus bristles ca. 8 mm long, tapered at tips, without enlarged apical cells. Pollen grains ca. 28 μm diam.

The single known specimen of this species is cited from "bosque pluvial Premontano," and "bosque primario." The species seems most distinct in the glabrous elliptical leaves with ascending secondary veins and veinlets strongly raised above the surface. The narrowly racemiform-thyrsoid lateral inflorescences with narrow, homogamous heads are also somewhat distinctive.

Pentacalia (subg. *Pentacalia*) **pailasensis** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Santiago–Zamora: trail between Mirador and Pailas, 2,010–2,255 m, 9 Sep. 1943, *Steyermark 54275* (holotype, F).

In foliis planis integris glabris in venulis prominulis in inflorescentiis lateralibus brevibus racemiformibus et in capitulis heterogamis disciformis differt.

Plants scandent, indefinitely elongate; stems weakly striate, sparsely puberulous when young, becoming glabrous, narrowly fistulose. Leaves alternate, petioles 0.6–0.9 cm long; blades not arched, not drying conduplicate, elliptical, weakly subcoriaceous, glabrous, mostly 7–10 cm long, 0.19–4.0 cm wide, base short-acute, margins entire, apex short-acuminate, veins prominent below, reticulum of veinlets slightly but distinctly raised above the surface; secondary veins ca. 6 on each side, spreading at 60–70°, arching upward and joining well inside of margin. Inflorescences lateral from axils of leaves, slightly less long than the leaves, unbranched basal part 2.0–2.5 cm long, weakly puberulous, distal part mostly racemiform, bearing small subulate or linear bractlets to 8 mm long, with heads solitary or in pairs on short lateral branches; peduncles lacking to 5 mm long, minutely puberulous. Heads 8–9 mm high, heterogamous, disciform; calycular bracts 2 or 3, narrowly subulate, 2–3 mm long, glabrous; involucral bracts ca. 8, glabrous, 5–6 mm long, 1–2 mm wide, short-acute. Female florets ca. 4; corollas yellow, tubular, glabrous, tube ca. 4 mm long, lobes ca. 1 mm long, ca. 0.4 mm wide at base. Disk florets ca. 16; corollas yellow, glabrous, tube ca. 3 mm long, throat ca. 2 mm long, lobes ca. 1.5 mm long, 0.5 mm wide, tips scarcely thickened with sclerified mamillose cells outside; anther collar with cells of the short, broadened base poorly thickened in material seen; anther thecae ca. 1.8 mm long, basal tails half to two-thirds as long as collar, apical appendage narrowly oblong, 0.28 mm long, ca. 0.01 mm wide. Achenes ca. 1.5 mm long, glabrous; pappus bristles 5–6 mm long, tips not broadened. Pollen grains 27–30 μm diam.

The new species keys out close to *Pentacalia sevillana* and seems most closely related to that species. The latter differs most obviously by its arched leaf blades that are commonly conduplicate when pressed, by the more ascending secondary veins that reach near the leaf margin, and by the much longer, mostly narrowly thyrsoid inflorescences with strictly sessile heads.

Pentacalia (subg. *Pentacalia*) **palaciosii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Napo: Canto El Chaco, márgen derecha del Río Quijos, Finca "La Ave Brava" de Segundo Pacheco, 77°39′W, 00°12′S, 1,800–1,900 m, 7–10 Sep. 1990, *Palacios 5303* (holotype, US; isotype, MO).

In foliis herbaceis vel tenuiter coriaceis in inflorescentiis pyramidaliter thyrsoideis et in capitulis heterogamis disciformis distincta.

Plants scandent or shrubby, often indefinitely elongate; stems roughened by persistent bases of evanescent hairs, narrowly fistulose. Leaves alternate, petioles ca. 1.5 cm long, with rough surface; blades oblong-ovate, firmly herbaceous to thinly coriaceous, glabrous, 1.0–1.3 cm long, 4–5 cm wide, base obtuse to rounded with short acumination, margins entire, apex short-acuminate, upper surface dark, glabrous, with veins and veinlets scarcely raised above surface, lower surface somewhat paler, sparsely puberulous, with veins and veinlets distinctly raised above surface, included veinlets slightly raised above surface; secondary veins ca. 10 on each side, spreading at 60° or more. Inflorescence lateral from axils of leaves, nearly twice as long as leaves, bearing only reduced bracts, broadly thyrsoid with branches ascending at 30–60°, basal bracts elliptical, 3–4 cm long, 0.9–1.5 cm wide, upper bracts papery, mostly 0.5–1.5 cm long, 0.1–0.3 cm wide, more sharply acute; peduncles 0.7–1.3 cm long, minutely puberulous. Heads 9–10 mm high, heterogamous, disciform; subcalycular and calycular bracts 1 or 2, narrowly subulate, 3–4 mm long, glabrous; involucral bracts ca. 8, glabrous, ca. 8 mm long, 1.0–1.5 mm wide, apices short-acute. Female florets ca. 4; corollas yellow, tubular, tube ca. 6 mm long, lobes ca. 1.3 mm long, ca. 0.5 mm long at base. Disk florets ca. 20; corollas yellow, glabrous, tube 4–5 mm long, throat ca. 2 mm long, lobes ca. 1.3 mm long, 0.5–0.6 mm wide, tips not thickened, with nearly plain shield paved with large cells bearing central papillae outside; anther thecae ca. 1.5 mm long, basal tails half as long as collar, apical appendage narrowly oblong, ca. 0.3 mm long, 0.1 mm wide. Achenes ca. 1.8 mm long, glabrous; pappus bristles ca. 6 mm long, tips not broadened. Pollen grains ca. 30 μm diam.

In general aspect of leaf venation and position of inflorescences, the new species seems closest to *Pentacalia hurtadoi* described above, also from Napo. The leaves of the latter differ by the fewer secondary veins, the veinlets that are not prominent, the homogamous heads, and the shorter, more racemiform inflorescences without small leafy bracts near the base.

Pentacalia (subg. *Pentacalia*) **zakii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Pichincha: Reserva Floristica—Ecológico "Rio Guajalito," km 59 de la carretera antigua Quito–Sto. Domingo de los Colorados, a 3.5 km al NE de la carretera estribaciones occidentalus del Volcán Pichincha, 00°13′53″S, 78°48′10″W, 1,800–2,200 m, 18 Sep. 1986, *Zak 1213* (holotype, US; isotype, MO).

In foliis late oblongis integris glabris in inflorescentiis lateralibus axillaribus foliis longioribus distaliter corymbosis in capitulis subsessilibus heterogamis disciformibus distincta.

Plants scandent, indefinitely elongate; stems striated, sparsely and finely puberulous, producing many short adventitious roots, with solid pith. Leaves alternate, petioles ca. 1.8 cm long; blades herbaceous to thinly subcoriaceous, broadly oblong, 12–13 cm long, 5.5–6.0 cm wide, base obtuse with slight acumination, margins entire, apex subacute and short-acuminate, upper and lower surfaces with veins and veinlets slightly raised above surface, essentially glabrous, slightly paler below, with ca. 6 widely spreading, strongly arching secondary veins on each side. Inflorescences lateral from axils of vegetative leaves, half again as long as leaves, with long, unbranched, leafless basal part 10–12 cm long, corymbosely branched distally, branches ending with 2 or 3 subsessile heads; peduncles 0.5–1.0 mm long, finely puberulous. Heads 9–10 mm high, heterogamous, disciform; calycular bracts 2 or 3, subulate, ca. 1.5 mm long, glabrous; involucral bracts 7 or 8, glabrous, ca. 7 mm long, 1.0–1.3 mm wide, apices narrowly acute. Female florets ca. 4, tubular; corollas white, glabrous, ca. 6 mm long, tube ca. 4 mm long, lobes ca. 1.7 mm long, 0.4 mm wide. Disk florets ca. 10; corollas white, glabrous, 6.0–6.5 mm long, tube 3.0–3.5 mm long, throat ca. 1.5 mm long, lobes ca. 2 mm long, 0.5–0.6 mm wide, tips minimally thickened with subsclerified shield of large, somewhat bulging cells outside; anther thecae ca. 1.5 mm long, basal tails ca. half as long as collar, apical appendage narrowly oblong, ca. 0.35 mm long, 0.13 mm wide. Achenes 2.0–2.5 mm long, glabrous, usually 5-ribbed; pappus bristles 4.0–4.5 mm long, tips not or scarcely broadened. Pollen grains ca. 27 μm diam.

Pentacalia zakii seems closest to *P. huilensis* (J. Cuatrecasas) J. Cuatrecasas of western Colombia and cited here from Ecuador: Pichincha: Parroquia Nanegal, *Webster & Castro 28943* (US). The latter species has leaf blades of similar texture and indument and lateral inflorescences with long, unbranched bases. *Pentacalia huilensis* differs primarily by having distinctly ligulate rays, but also has thicker and more ovate leaves with more ascending secondary veins. The presence of adventitious roots on the stem of the new species may be

variable, but no such roots have been seen in *P. huilensis*. The inflorescence of *P. huilensis* has a terminal, nearly sessile, corymbose inflorescence on the tapering tips of the stems in addition to the axillary lateral inflorescences, and the same form may be seen in the new species when more material is examined.

Pentacalia (subg. *Pentacalia*) **zamorana** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Zamora: road from Loja to Zamora, km 12–14, elev. 2,800 m, 18 Nov. 1961, *Dodson & Thien 1375* (holotype, US; isotype, SEL).

In foliis acutissimis argute dentatis glabris in inflorescentiis terminalibus dense pyramidaliter paniculatis et in capitulis sessilibus heterogamis disciformis distincta.

Plants scandent, indefinitely elongate; stems glabrous, striate, not or narrowly fistulose. Leaves alternate, petioles 0.5–0.7 cm long; blades coriaceous, ovate, 3–6 cm long, 1.7–3.5 cm wide, base rounded, margins regularly and sharply dentate, apex apiculate, surfaces with veins and veinlets strongly to moderately raised above surface, glabrous or rarely with traces of evanescent arachnoid tomentum near midvein; secondary veins ca. 6 on each side, spreading at 75–85° angles. Inflorescences terminal, densely pyramidal with widely spreading lower branches, with only small subulate bracts. Heads sessile in mostly small clusters, ca. 6 mm high, heterogamous, disciform; calycular bracts 3 or 4, subulate, 1.0–1.5 mm long, with few hairs; involucral bracts ca. 8, glabrous, ca. 4 mm long, 1.0–1.5 mm wide, apices obtuse to short-acute. Female florets 3 or 4; corollas white, tubular, glabrous, tube ca. 2.3 mm long, lobes ca. 0.8 mm long. Disk florets ca. 10; corollas white, glabrous, ca. 4.5 mm long, tube ca. 1.8 mm long, throat ca. 1.8 mm long, lobes ca. 1 mm long, 0.5 mm wide, tips somewhat thickened with sclerified shield of many narrow papillae outside; anther thecae ca. 1 mm long, with basal tails half as long as collar; apical anther appendage oblong, ca. 0.25 mm long, 0.17 mm wide. Achenes ca. 1.5 mm long, glabrous, 5-ribbed; pappus bristles ca. 4 mm long, without enlarged apical cells. Pollen grains ca. 30 μm diam.

The new species seems closest to *P. millei* from the same general area of southern Ecuador. The latter has only small teeth on the leaf margins and evanescent arachnoid tomentum on the leaf undersurface and the surface of the involucral bracts.

Paratype. ECUADOR. **Zamora:** road from Loja to Zamora, km 12–14, elev. 2,800 m, 18 Nov. 1961, *Dodson & Thien 1375* (SEL).

Key to the Species of *Pentacalia* subg. *Pentacalia* in Ecuador

1a. Heads with distinct rays.
  2a. Stem becoming slightly but distinctly inflated near base of the terminal inflorescence; inflorescence with primary bracts large, foliose, oblong; rays white ..... *P. luteynorum* H. Robinson & J. Cuatrecasas
  2b. Stem not or scarcely swollen at base of inflorescence, usually without large primary bracts in terminal inflorescences; rays yellow.
    3a. Inflorescences mostly or completely lateral from axils of full-sized vegetative leaves.
      4a. Stems and leaf undersurfaces with numerous crisped hairs; lateral inflorescences with foliose bracts on basal part ..... *P. carmelana* H. Robinson & J. Cuatrecasas
      4b. Stems and leaf surfaces essentially glabrous; lateral inflorescences without foliose bracts on basal part.
        5a. Involucral bracts ca. 8; veinlets of leaf blade often slightly raised above surface ..... *P. huilensis* (J. Cuatrecasas) J. Cuatrecasas
        5b. Involucral bracts 5–7; leaf surface plane, with veinlets completely immersed ..... *P. riotintis* (J. Cuatrecasas) J. Cuatrecasas
    3b. Inflorescences mostly or wholly terminal on leafy branches.
      6a. Leaves with tomentum spread over entire undersurface.
        7a. Leaves small, 2–5 cm long, ovate, blunt; stems and leaf undersurfaces rufotomentose ..... *P. ruficaulis* (Greenman & J. Cuatrecasas) J. Cuatrecasas
        7b. Leaves large, mostly 6–14 cm long, ovate-oblong, blunt; stems and leaf undersurfaces thinly arachnoid tomentose ..... *P. campii* (J. Cuatrecasas) J. Cuatrecasas
      6b. Leaves glabrous or with tomentum only on midrib beneath.
        8a. Leaf blades oblong or obovate, with apices rounded or obtuse to short-acute.
          9a. Leaf blades oblong, with bases obtuse to short-acute, apices often rounded; veinlets distinctly raised above the surface ..... *P. corazonensis* (Hieronymus) J. Cuatrecasas
          9b. Leaf blades obovate, with cuneate bases, apices obtuse to short-acute; veinlets scarcely raised above surface ..... *P. dorrii* H. Robinson & J. Cuatrecasas
        8b. Leaf blades ovate, with apices acute.
          10a. Leaf with trinervate venation; surface smooth, with veinlets not pellucid; margins entire ..... *P. lanceolifolia* (J. Cuatrecasas) J. Cuatrecasas

10b. Leaf venation pinnate; surface with pellucid veinlets raised above surface; margins often with a few teeth ..... *P. andrei* (Greenman) J. Cuatrecasas

1b. Heads disciform or homogamous, without obvious rays.

11a. Heads homogamous, all florets bisexual.

12a. Leaf margins entire; inflorescences mostly or wholly lateral from axils of full-sized leaves.

13a. Leaf blades elliptic or oblong, fleshy with secondary veins obscure; inflorescences loosely racemiform-thyrsoid; corollas yellow ..... *P. moronensis* H. Robinson & J. Cuatrecasas

13b. Leaf blades elliptical, with prominent secondary veins; inflorescences mostly racemiform; corollas white.

14a. Leaf blades smooth between secondary veins; pith of stems solid; secondary veins arching and joining well inside of margin .. *P. hurtadoi* H. Robinson & J. Cuatrecasas

14b. Leaf blades with veinlets raised above surface; stems fistulose; secondary veins rather evenly ascending almost to margin ..... *P. napoensis* H. Robinson & J. Cuatrecasas

12b. Leaf margins with teeth; inflorescences terminal or subterminal from axils of reduced leaves.

15a. Leaf blades densely tomentose below; heads sessile; corollas yellow ..... *P. gibbiflora* (J. Cuatrecasas) J. Cuatrecasas

15b. Leaf blades glabrous or sparsely pubescent below; heads pedunculate; corollas white or greenish white.

16a. Leaves narrowly ovate to elliptical .... *P. hitchcockii* (J. Cuatrecasas) J. Cuatrecasas

16b. Leaves ovate.

17a. Axis of inflorescence mostly straight; leaves with secondary veins spreading at nearly 90° ..... *P. arborea* (HBK) H. Robinson & J. Cuatrecasas

17b. Axis of inflorescence ± zigzagged; leaves with secondary veins spreading at 70–80° angles ..... *P. theaefolia* (Bentham) J. Cuatrecasas

11b. Heads heterogamous, with tubular peripheral female florets.

18a. Leaf margins denticulate; inflorescences terminal.

19a. Leaf blades large, to 20 cm long, with closely and acutely denticulate margins; heads pedunculate ..... *P. floribunda* J. Cuatrecasas

19b. Leaf blades mostly less than 10 cm long, with less than 20 teeth on each margin; heads sessile.

20a. Undersurfaces of leaves with dense tomentum; branches of inflorescences often retroflexed, directed backward ..... *P. oronocensis* (DC.) J. Cuatrecasas

20b. Undersurfaces of leaves glabrous or with evanescent arachnoid tomentum; branches of inflorescences not retroflexed.

21a. Margins of leaf blades with small mucronate-denticulations; stems, leaf undersurfaces, and inflorescences with distinct evanescent arachnoid tomentum ..... *P. millei* (Greenman) J. Cuatrecasas

21b. Margins of leaf blades with numerous sharp teeth and intervening rounded sinuses; stems, leaves, and most of each inflorescence essentially glabrous ..... *P. zamorana* H. Robinson & J. Cuatrecasas

18b. Leaf margins entire; inflorescences partially or wholly lateral from axils of full-sized vegetative leaves.

22a. Undersurfaces of leaf blades and involucral bracts pubescent.

23a. Heads 10–13 mm high from base of receptacle to tips of disk florets, with ca. 40 disk florets and 10–12 short-ligulate, 3–5-lobed peripheral female florets ..... *P. hillii* (Greenman) J. Cuatrecasas

23b. Heads mostly 9–10 mm high, with 16–30 disk florets and 4–7 peripheral female florets.

24a. Peripheral female florets 6–7, tubular, 5-lobed; bisexual disk florets 25–30 ..... *P. disciformis* (Hieronymus) J. Cuatrecasas

24b. Peripheral female florets ca. 4, subradiate, with deeply 3-lobed limb; bisexual disk florets 17–19 ..... *P. carchiensis* (J. Cuatrecasas) J. Cuatrecasas

22b. Leaf blades and involucral bracts glabrous.

25a. Lateral inflorescences with naked, long, unbranched basal parts that are longer than distal branching part, corymbiform distally; leaves broadly oblong ..... *P. zakii* H. Robinson & J. Cuatrecasas

25b. Lateral inflorescences with basal parts short or closely bractiferous, thyrsoid or racemiform distally; leaves ovate or elliptical.

26a. Leaf blades smooth except for midvein, secondary and tertiary veins obscure; corollas white ..... *P. cazaletii* H. Robinson & J. Cuatrecasas

26b. Leaf blades with prominent secondary veins and weakly to strongly raised veinlets; corollas yellow or pale yellow.

27a. Heads loosely racemose, disposed on slender peduncles; bases of lateral inflorescences with foliose bracts ..... *P. palaciosii* H. Robinson & J. Cuatrecasas

27b. Heads sessile or subsessile; bases of lateral inflorescences often with only small subulate bracts.
  28a. Leaf blades somewhat arched, often conduplicate when pressed; secondary veins reaching near leaf margin; inflorescence longer than subtending leaves, distinctly thyrsoid with branches bearing many sessile heads ... *P. sevillana* (J. Cuatrecasas) J. Cuatrecasas
  28b. Leaf blades pressing flat; secondary veins strongly upwardly curved and joining well inside of margin; inflorescence not longer than subtending leaves, mostly racemiform with shortly pedunculate heads ..... *P. pailasensis* H. Robinson & J. Cuatrecasas

NEW SPECIES OF *PENTACALIA* (SUBG. *PENTACALIA*) IN PERU

Pentacalia (subg. *Pentacalia*) **balsasana** J. Cuatrecasas & H. Robinson, sp. nov. TYPE: Peru. Cajamarca: Celendín, Río Marañon, canyon above Balsas, 3–4 km below summit, rd. to Celendín, alt. 2,950 m, 21 May 1964, *Hutchison & Wright 5212* (holotype, US; isotypes, F, UC, USM).

In nodis prominentibus in foliis oppositis in laminis oblongis base rotundatis vel breviter acutis subtus cinereo-tomentosis in capitulis radiatis et in bracteis involucri ca. 13 distincta.

Shrubs ca. 2 m high; stems somewhat hexagonal, thinly white-lanuginose, nodes appearing swollen with persistent enlarged bases of petioles, with solid pith. Leaves opposite, petioles 1.0–1.5 cm long, 0.8–1.3 cm wide above enlarged persistent bases; blades subcoriaceous, 2.5–8.0 cm long, 1.0–2.8 cm wide, base rounded to short-acute, margins with numerous minute, close denticulations, sinuses as wide as deep, apex obtuse to short-acute, upper surface shiny green with slight evanescent, whitish, arachnoid wool, lower surface covered with dense whitish tomentum; secondary veins ca. 8 on each side, widely spreading, reticulum of veinlets prominent below. Inflorescence terminal, and from axils of uppermost reduced leaves, broadly cymose with corymbose branches; peduncles 0.3–1.5(–2.7) cm long, thinly whitish tomentose. Heads 10–13 mm high, heterogamous, radiate; 8–10 calycular bracts and few subinvolucral bracteoles 3–4 mm long, 0.6–0.7 mm wide, with few arachnoid hairs, with tips acute and brownish, margins minutely ciliate; involucral bracts ca. 13, ca. 6 mm long, mostly oblong, 1.7–1.9 mm wide, outermost linear, ca. 1 mm wide, all glabrous with acute ciliate apices. Ray florets 10; corollas yellow, glabrous, 10–12 mm long, tube 3.0–3.5 mm long, limb oblong-elliptical, ca. 8 mm long, 2.2–2.4 mm wide. Disk florets ca. 29; corollas yellow, ca. 8 mm long, glabrous, tube ca. 3 mm long, throat ca. 5 mm long, lobes ca. 1 mm long, 0.8–0.9 mm wide, lobes scarcely thickened at tips with scarcely bulging cells outside; anther thecae ca. 2.5 mm long, basal tails a third and a half as long as collar, apical appendage oblong-ovate, ca. 0.4 mm long, 0.25 mm wide. Achenes submature, 2.5–3.0 mm long, glabrous, weakly 5-ribbed; pappus bristles ca. 6 mm long, with long-projecting but not broadened apical cells. Pollen 37–40 μm diam.

The type is described on the label as fairly common, fragrant, a shrub to 2 m, coarse, with leaves glossy above, woolly below, and leathery. *Pentacalia balsasana* is one of three species of this genus in Peru with opposite leaves. Of the others, *P. wurdackii* differs by being obviously a vine, by its lack of persistent petiole bases, its glabrous leaves, fewer involucral bracts, its lack of rays, and its more deeply cut corolla lobes. *Pentacalia vargasiana* from southern Peru is described as a shrub, but has cordate bases and sparse pubescence on the undersurfaces of the leaves, lacks the persistent petiole bases, has the shortest anther tails seen in the subgenus, and has longer corolla lobes with more thickened and roughened tips. The three species do not seem closely related.

Paratype. PERU. **Cajamarca:** Celendín, Río Marañon canyon, above Balsas, 3–4 km below summit on road to Celendín, alt. 2,950 m, 21 May 1964, *Hutchison & Wright 5212A* (F, UC, US, USM).

Pentacalia (subg. *Pentacalia*) **cutervonis** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Cajamarca: Cutervo National Park, 12 km NE of San Andres de Cutervo, transect 4, 06°10′S, 78°40′W, 2,230 m, 11 Sep. 1991, *Gentry, Diaz & Ortiz 74653* (holotype, US; isotype, MO).

In foliis herbaceis vel subcoriaceis subtus puberulis in nervulis reticulato-prominulis in inflorescentiis lateralibus et in capitulis homogamis brevibus distincta.

Plants scandent, arborescent? to 12 m tall; stem pale, terete, finely striate, coarsely puberulous, with solid pith. Leaves alternate, petioles 1.2–1.4 cm long; blades herbaceous to thinly subcoriaceous, elliptical, 9–10 cm long, 3.0–3.8 cm wide, base acute,

margins entire, apex shortly and narrowly acuminate, surfaces with a distinct network of raised veinlets, glabrous above, sparsely puberulous below; ca. 7 secondary veins on each side, ascending at ca. 35°. Inflorescences lateral, from axils of vegetative leaves, usually somewhat shorter than leaves, narrowly thyrsoid, with short, few-headed lateral branches beyond basal third; peduncles 2–7 mm long, finely puberulous. Heads ca. 7 mm high, homogamous; few subinvolucral and calycular bracteoles subulate, 1.5–2.0 mm long, sparsely puberulous; involucre of flowering heads with partially spreading tips when dry; involucral bracts 8, sparsely, minutely puberulous outside, 4.5–5.0 mm long, 1.0–1.8 mm wide, subobtuse to short-acute. Ray florets lacking; disk florets ca. 12; corollas yellow, glabrous, ca. 7 mm long, tube ca. 3 mm long, throat ca. 1.5 mm long, lobes ca. 1.5 mm long, 0.6 mm wide, scarcely thickened at tip, nearly smooth outside; anther thecae ca. 1.3 mm long, with basal tails ca. half as long as collar; apical anther appendage narrowly oblong, ca. 0.45 mm long, ca. 0.13 mm wide. Achenes immature, ca. 0.8 mm long, glabrous, 5-ribbed; pappus bristles ca. 4.5 mm long, not broadened at tips. Pollen grains 35–37 μm diam.

The paratype specimen is cited from a humid cloud forest. The type is clearly stated to be a liana, but the paratype was collected in a tree fall and is described on the label as a tree to 12 m? The new species does not seem particularly close to others in Peru. In the shape of the leaf, the ascending secondary veins, the veinlets raised above the surface, the general form of the inflorescence, and the homogamous heads, the new species seems closest to *P. napoensis* described above from Ecuador. The latter species differs by its glabrous stems, leaves, and involucres, the mostly unbranched lateral branches of its inflorescences, and its shorter heads. The secondary veins of the present species seem somewhat less ascending than in the Ecuadorian species.

Paratype. PERU. **Amazonas:** Prov. Bagua, Cordillera Colán Se of La Peca, Third camp, elev. 5,900–6,125 ft., 17 Oct. 1978, *Barbour 4124* (MO, US).

Pentacalia (subg. *Pentacalia*) **davidsmithii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Pasco: Prov. Oxapampa, near Cerro Pajonal, 24 km from Oxapampa, 2,580–2,600 m, 9 Oct. 1982, *David N. Smith 2565* (holotype, US; isotype, MO).

In foliis coriaceis integris, in inflorescentiis terminalibus late ovoideis thyrsoideis in capitulis heterogamis radiatis in bracteis involucralibus 10–13 et in cellulis apicalibus pappi inflatis distincta.

Scrambling or prostrate subshrubs, with branches several meters long; stems terete, striate, pale brownish tomentellous, broadly fistulose. Leaves alternate, petioles 0.5–1.7 cm long; blades somewhat fleshy, drying coriaceous, glabrous, elliptical, 7–13 cm long, 1.7–5.2 cm wide, base rounded-obtuse to acute, margins entire, scarcely reflexed, apex short-acuminate, subglabrous above with few small hairs mostly on midvein, very sparsely puberulous below; 5 or 6 secondary veins on each side spreading at 50–55°, scarcely raised above surface below, other venation obsolete. Inflorescence terminal, broadly rounded, thyrsoid, about as wide as high, with reduced leaves at lower nodes, smaller subsessile tomentellous foliose bracts at median nodes, progressively smaller, linear bracts at upper nodes 0.5–1.0 cm long; branches mostly unbranched in basal half or more, corymbose distally; peduncles 0.8–2.8 cm long, pale tomentellous. Heads 10–12 mm high, heterogamous, radiate; few subinvolucral and 4 or 5 calycular bracteoles subulate, 2.0–2.5 mm long, sparsely puberulous; involucre broadly campanulate, 6–7 mm wide; involucral bracts 10–13, tomentellous on much of surface, ca. 6 mm long, 1.3–1.8 mm wide, apices acute. Ray florets 8; corollas yellow, glabrous, tube ca. 5 mm long, limb ca. 10 mm long. Disk florets ca. 25; corollas yellow, glabrous, ca. 9.5 mm long, tube ca. 3.5 mm long, throat ca. 4.5 mm long, lobes ca. 2 mm long, 0.8 mm wide, thickened at tip with many bulging cells outside; anther thecae ca. 2.5 mm long, basal tails often slightly longer than collar; apical anther appendage oblong-ovate, ca. 0.4 mm long, 0.25 mm wide. Achenes ca. 1.8 mm long, glabrous, 5-ribbed; pappus bristles ca. 8 mm long, distally broadened at tips with many inflated apical cells. Pollen grains 47–50 μm diam.

The only known specimen of this species is cited from high montane moist forest. It is stated to have the "inflorescence erect, terminal or axillary (apparently by secondary dominance in horizontal branches)." The flowers are said to have a "sweet composite odor." The new species is considered closest to the Peruvian *Pentacalia carpishensis* and *P. poyasensis*, which have leaves of similar shape and texture and heads with mostly 13 involucral bracts. Both the latter species have a marked tendency for lateral inflorescences and lack enlarged tips on the pappus bristles. *Pentacalia poyasensis* also usually has disciform heads, scarcely fistulose stems, and more glabrous stems, leaves, and involucres.

Pentacalia (subg. *Pentacalia*) **maynasensis** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Loreto: Prov. Maynas, Yanamono Explorama Tourist Camp, halfway between Indiana and mouth of Río Napo, 130 m, 2 Aug. 1988, *van der Werff, Vásquez & Jaramillo 9937* (holotype, US; isotype, MO).

In foliis ovato-ellipticis in nervis secundariis ascendentibus in capitulis heterogamis disciformibus et in involucris turbinatis distincta.

Plants scandent, to 15 m tall, indefinitely elongate; stem terete, striate, glabrous, fistulose. Leaves alternate, petioles slender, 1–2 cm long; blades herbaceous to subcoriaceous, glabrous, ovate-elliptical, mostly 5–9 cm long, 2–4 cm wide, base short-acute, margins entire, apex short-acuminate; 3 or 4 secondary veins on each side, ascending at 30–35°, slightly raised above surface below when dry, blades otherwise smooth. Inflorescence terminal, thyrsoid, ovoid, with reduced leaves or foliiform bracts at lower nodes; branches widely spreading, becoming narrowly pyramidal distally; peduncles 3–6 mm long, whitish tomentellous. Heads 10–11 mm high, heterogamous, disciform; subinvolucral and ca. 4 calycular bracteoles subulate, 2.0–2.5 mm long, essentially glabrous; involucre turbinate, broader in basal half, contracted above at anthesis; involucral bracts ca. 8, glabrous, ca. 7 mm long, 1.0–1.5 mm wide, short-acute. Female florets 4 or 5; corollas yellow, glabrous, tubular, tube ca. 5 mm long, throat ca. 2 mm long, lobes ca. 0.8 mm long, 0.25 mm wide. Disk florets 12–14; corollas yellow, glabrous, ca. 10 mm long, tube ca. 6 mm long, throat ca. 2 mm long, lobes ca. 1.5 mm long, 0.6 mm wide, scarcely thickened and with few bulging cells at tip; anther thecae ca. 1.8 mm long, with basal tail usually almost as long as collar; apical anther appendage narrowly oblong, ca. 0.2 mm long, ca. 0.1 mm wide. Achenes ca. 1.2 mm long, glabrous, 5-ribbed; pappus bristles ca. 8 mm long, distinctly broadened at tips, apical cells with short rounded projections. Pollen grains ca. 33 μm diam.

The only known specimen of this species is cited from nonflooded forest on rather fertile soil. The new species keys to *Pentacalia lucidissima* of Huánuco, Peru, in Cabrera (1954), but the latter has homogamous heads, lateral inflorescences, and midveins of leaves that are tomentellous. The enlarged tips of the longer pappus bristles of the new species may prove to be a useful distinction.

Pentacalia (subg. *Pentacalia*) **mucronatifolia** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Amazonas: Luya Prov., Camporredondo–Tullanya, trocha hacia el Cerro Huicsocunga, 2,350 m, 2 Sep. 1989, *Díaz & Campos 3704* (holotype, US; isotype, US).

In foliis ovato-oblongis prominulo-reticulatis apice abrupte apiculatis margine mucrono-denticulatis in inflorescentiis terminalibus dense pyramidalibus in ramulis spicatis et in capitulis sessilibus disciformibus non vel vix heterogamis distincta.

Plants scandent, indefinitely elongate; stems terete, striate, minutely puberulous, fistulose. Leaves alternate, petioles mostly rather short, 0.5–1.0 cm long; blades oblong-ovate, mostly 4.5–7.0 cm long, 3.5–5.0 cm wide, base broadly rounded, margins with few to many remote mucronate denticulations, apex rounded with abrupt, slender apiculus, upper and lower surface with prominent network of veinlets, sparsely puberulous or hispidulous, with very sparse arachnoid hairs; 6–8 secondary veins on each side, spreading at ca. 80°. Inflorescence terminal, pyramidal, with densely pyramidal branches; branchlets spicate with heads grouped in successive clusters; primary bracts linear to narrowly elliptical, 0.8–2.5 cm long. Heads sessile, ca. 7 mm high, often heterogamous, disciform; calycular bracts 5 or 6, linear, glabrous, 1.0–1.5 mm long; involucral bracts ca. 8, oblong, glabrous, 3.5–4.0 mm long, ca. 1 mm wide, acute. Female florets 0–1; corollas tubular, yellow, glabrous, tube ca. 2.5 mm long, lobes ca. 1 mm long. Disk florets ca. 8; corollas yellow, glabrous, 5.5–6.0 mm long, tube ca. 2 mm long, throat ca. 1.5 mm long, lobes ca. 1.2 mm long, 0.5 mm wide, moderately thickened at tip with cluster of many enlarged cells outside; anther thecae ca. 1.2 mm long, basal tails half as long to as long as collar, apical appendage ca. 0.35 mm long, 0.15 mm wide. Achenes ca. 1.5 mm long, glabrous; pappus bristles 3.5–4.0 mm long, tips not or scarcely broadened. Pollen grains ca. 27 μm diam.

The single collection of this species is cited from cloud forest. The species can be distinguished by the narrow abrupt apiculus of the leaves or by the densely pyramidal terminal inflorescence with heads sessile on rather spicate branchlets. The female florets in the heads are not obvious and seem to be lacking in many heads.

Pentacalia (subg. *Pentacalia*) **nunezii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Cusco: Urubamba, Machupicchu, a 107 km de Cusco, entre Wiñayhuayna e Intipunca, 13°09′S, 72°31′W, 2,900 m, 26 Oct. 1987, *Nuñez 8408* (holotype, US; isotype, MO).

In foliis herbaceis vel subcoriaceis oblongis integris subtus minime persparse tomentellis in inflorescentiis terminalibus ovoideis et in capitulis pedunculatis radiatis distincta.

Plants scandent, indefinitely elongate; stem terete and striate, becoming irregularly ridged, thinly tomentellous, with solid pith. Leaves alternate, petioles 0.5–1.0 cm long; blades herbaceous to subcoriaceous, oblong-elliptical, mostly 4–8 cm long, 1.2–3.2 cm wide, base short-acute, margins entire, slightly reflexed, apex obtuse to short-acute, often with slight apiculus, upper surface glabrous with puberulous midvein, lower surface scarcely paler, with sparse arachnoid puberulence, denser toward midvein; 8 or 9 widely spreading secondary veins on each side, veinlets slightly raised above surface. Inflorescence terminal and from axils of somewhat reduced upper leaves, thyrsoid, ovoid, with widely spreading branches ending in loose pyramidal clusters of heads; peduncles 5–15 mm long, densely puberulous. Heads 10–12 mm high, heterogamous, radiate; calycular bracts ca. 5, subulate to linear, 1.0–3.5 mm long, finely puberulous; involucral bracts ca. 13, tomentellous outside, oblong-lanceolate, 5–6 mm long, ca. 1.5 mm wide, acute. Ray florets ca. 10; corollas yellow, glabrous, tube 4–5 mm long, limb 8–9 mm long. Disk florets ca. 25; corollas yellow, tube ca. 3.5 mm long, throat ca. 3.5 mm long, lobes ca. 1 mm long, ca. 0.5 mm wide, thickened tip with many narrow papillae outside; anther thecae ca. 2.5 mm long, basal tails one-third to two-thirds as long as collar; anther appendage oblong, ca. 0.45 mm long, 0.23 mm wide. Achenes ca. 2.0–2.2 mm long, 5-ribbed; pappus bristles 6–7 mm long, with somewhat broadened, more scabrid tips. Pollen grains ca. 30 μm diam.

The single specimen of this species is cited from bosque de ceja de selva, with *Clethra*, *Podocarpus*, and *Alnus*. The new species keys to *Pentacalia carpishensis* in Cabrera (1954), but differs by the larger heads and the thinner and narrower leaf blades with denser, more crowded secondary veins. All specimens examined of *Pentacalia carpishensis* also differ by having lateral inflorescences.

Pentacalia (subg. *Pentacalia*) **sagasteguii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Cajamarca: Prov. Cajamarca, La Encañada, 2,750 m, 17 Aug. 1984, *Sagástegui, Mostacero & Leiva 12012* (holotype, US; isotype, MO).

In foliis margine dense crenulo-denticulatis in reticulis venulosis distinctis in bracteis involucri ca. 13 in lobis corollarum glanduliferis et in ductis resiniferis acheniorum prominentibus distincta.

Spreading subshrubs or shrubs, 2 m or more high; stems sparsely to densely puberulous, with solid pith. Leaves alternate, petioles 0.2–0.4 cm long, to 2 cm in paratypes *Sagástegui et al. 9001* and *Hutchison & Wright 5387*; blades herbaceous, ovate to elliptical, 5–12 cm long, 1.5–4.5 cm wide, base acute to subobtuse, margins closely crenulate-denticulate, sometimes subentire in uppermost leaves, apex acute, upper surface scarcely to densely puberulous, with veinlets slightly insulcate, lower surface slightly paler with darker recessed reticulum of veinlets, sparsely puberulous on veinlets to brownish tomentose; secondary veins 6–8 on each side, spreading at 40–50°. Inflorescence terminal and from axils of reduced upper leaves, broadly pyramidal or rounded, with widely spreading branches; narrowly ovate to lanceolate foliiform bracts at bases of branches and branchlets 1–3 cm long, 0.5–1.3 cm wide; peduncles 4–18 mm long, densely puberulous. Heads 8–14 mm high, heterogamous, radiate; calycular bracts 4–6, herbaceous, linear, ca. 5 mm long, 1.0–1.2 mm wide, slightly shorter or longer than involucre, slightly to densely puberulous; involucral bracts ca. 13, ca. 5 mm long, 1.5–2.0 mm wide, acute, puberulous to subtomentose above. Ray florets 12–14; corollas yellow, glabrous, tube 3.5–4.5 mm long, limb 7.5–10.0 mm long. Disk florets 35–50; corollas yellow, mostly glabrous outside, tube 3.0–3.5 mm long, throat 4.0–4.5 mm long, lobes ca. 0.8 mm long, 0.7 mm wide, outer surface puberulous with small, cylindrical glands, tip somewhat thickened with moderately bulging cells outside; anther thecae ca. 2.5 mm long, basal tails ca. half as long as collar; apical appendage oblong-ovate, ca. 0.45 mm long, 0.25 mm wide; style tip with tuft of apical hairs, rather long in paratype *9001*. Achenes 2–3 mm long, large bulging resin ducts over veins forming 5 prominent ribs, glabrous, sometimes with few short setulae between ribs in paratype *12183*; pappus bristles ca. 6 mm long, tips broadened with cluster of enlarged, somewhat spreading, fusiform apical cells. Pollen grains 35–37 μm diam.

The specimens of this species are labeled as "arbusto" and "sufrútice," but the stems on the sheets have an elongate appearance that suggests a spreading or scrambling habit.

Among the Peruvian species of *Pentacalia*, the new species keys near *P. tablensis* (Cabrera) J. Cuatrecasas, *P. nunezii*, and *P. davidsmithii* because of the terminal inflorescences, pedunculate heads, ca. 13 involucral bracts, and prominent rays. The present species differs from these by the closely

crenulate-denticulate margins of the leaves. The corolla lobes of the new species have cylindrical glandular hairs outside, which contrasts with the glabrous condition of the corollas in most other members of the subgenus. The three specimens show differences in a number of characters, but they share a number of features and seem to be one species. The achenes of the three specimens are mature, and all show prominent enlarged resin ducts forming the ribs over the veins. The tips of the pappus have rather large spreading cells in all three specimens. The achenes are mostly glabrous, but some short setulae are seen in *Sagástegui 12183*. The holotype and *Sagástegui et al. 12183* have characteristically subsessile leaves. The third and fourth collections, *Sagástegui et al. 9001* and *Hutchison & Wright 5387*, have distinct petioles to 2 cm long. The latter specimens also have comparatively long hairs on the apices of the style and more strongly serrulate leaf margins.

Paratypes. PERU. **Cajamarca:** Contumazá, Shamón, arriba de Contumazá, 2,800 m, 8 July 1977, *Sagástegui, Alvitez & Mostacero 9001* (MO, US); Celendín, Gelig, Celendín—Balsas, 2,850 m, 18 Aug. 1984, *Sagástegui, Mostacero & Leiva 12183* (MO, US); canyon of Río Marañon above Balsas, 6 km below summit of road to Celendín, 2,850 m, 27 May 1964, *Hutchison & Wright 5387* (UC, US, USM).

Pentacalia (subg. *Pentacalia*) **tillettii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Amazonas: Prov. Pongará, Dist. Yambrasbamba, 1,860–2,000 m, 2 Mar. 1967, *Tillett 673-318* (holotype, US).

In foliis ovato-oblongis rigide carnosis in inflorescentiis lateralibus anguste cylindrice thyrsoideis et in capitulis radiatis distincta.

Shrubby vines growing to 10 m or more; stems glabrous, with solid pith. Leaves alternate, petioles 1.3–2.3 cm long; blades fleshy, brittle, ovate-oblong, 6–9 cm long, mostly 3.5–6.0 cm wide, base rounded to obtuse, margins entire, narrowly revolute, apex obtuse with small apiculus, surfaces glabrous, only midvein prominent below; ca. 5 widely spreading, arched secondary veins visible when dry. Inflorescences lateral from axils of vegetative leaves, 3–4 times as long as leaves, without foliose bracts basally; primary bracts chartaceous, oblong, 5–11 mm long, obtuse to acute, minutely puberulous; the numerous short lateral branches corymbose; peduncles slender, 2–7 mm long, minutely puberulous. Heads ca. 8 mm high, heterogamous, radiate; calycular bracts 2 or 3, narrowly subulate, to 2.5 mm long, with few small hairs; involucral bracts ca. 8, glabrous, ca. 5 mm long, 1.0–1.5 mm wide, apices short-acute. Ray florets ca. 6; corollas yellow, glabrous, tube ca. 4 mm long, limb ca. 4 mm long. Disk florets ca. 10; corollas yellow, ca. 7 mm long, tube ca. 3 mm long, throat 1.2–1.5 mm long, lobes ca. 2 mm long, ca. 0.5 mm wide, tips not thickened, with subsclerified small, somewhat bulging cells outside; anther thecae ca. 1.5 mm long, basal tail two-thirds as long as collar; apical appendage narrowly oblong, ca. 0.3 mm long, 0.12 mm wide. Achenes 2.0–2.2 mm long, glabrous, 5-costate; pappus bristles 4–5 mm long, tips not broadened. Pollen grains ca. 27 μm diam.

The label of the type and only known specimen states that the species is common throughout the area; the bark is brown-tan long-fibrous; the leaves are lustrous, dark green, fleshy, brittle, with a revolute margin, dark green above and medium green below; the flowers have a cheesy fragrance somewhat like Camembert; the phyllaries and inflorescence are light green, rays are bright yellow, disk flowers are darker tan-yellow, and anthers are brownish.

The specimen has been identified as *P. epiphytica*, which it resembles in its vegetative form, but the latter species, from Bolivia and southern Peru, has a very different terminal and broadly corymbose inflorescence.

Pentacalia (subg. *Pentacalia*) **todziae** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. San Martín: Prov. Ríoja, 99 km from Ríoja on road to Pomacocha, elev. 1,900 m, ca. 5°45′S, 77°35′W, 15 Feb. 1985, *Stein & Todzia 2180* (holotype, US; isotype, MO).

In foliis late ovatis coriaceis in inflorescentiis lateralibus in bracteis primariis subfoliiformibus oblongis in bracteis involucri 10–12 et in capitulis radiatis distincta.

Stout vines of indefinite length; stems terete, striate, glabrescent, fistulose. Leaves alternate, petioles ca. 6 cm long; blade fleshy, drying thick-coriaceous, broadly ovate, ca. 17 cm long, 14 cm wide, base broadly and shallowly cordate, margins entire, apex subacute, upper surface glabrous, lower surface somewhat paler, sparsely puberulous with minute, erect hairs; 6 or 7 secondary veins on each side, more spreading nearer base, prominent on lower surface, some prominent tertiary veins linking secondaries near margin. Inflorescences lateral from axils of vegetative leaves, 2–3 times as long as leaves, with axis minutely puberulous from base, regularly branching at 45–50° angles from near basal fourth; primary bracts foliiform, oblong, to 4 cm long and ca. 1 cm wide in median bracts, smaller below and above; peduncles 0.8–1.5 cm long, slen-

der, minutely puberulous. Heads 10–14 mm high, heterogamous, radiate; calycular bracts 2–4, linear, 2–3 mm long, minutely puberulous; involucral bracts 10–12, sparsely puberulous toward middle and base, ca. 7 mm long, 1.5 mm wide, rather narrowly acute. Ray florets ca. 8; corollas yellow, glabrous, tube ca. 5 mm long, limb ca. 9 mm long. Disk florets 25–30; corollas brownish yellow, glabrous, 8–10 mm long, tube 5–6 mm long, throat 2.0–2.5 mm long, lobes ca. 2 mm long, ca. 0.5 mm wide, tips moderately thickened with numerous enlarged cells outside; anther thecae ca. 1.5 mm long, with basal tails a fourth to three-fourths as long as collar; apical anther appendage oblong, ca. 0.3 mm long, 0.17 mm wide. Achenes 2.0–2.5 mm long, glabrous, 5-ribbed; pappus bristles ca. 9 mm long, not or slightly broadened at tips. Pollen grains ca. 30 μm diam.

The new species has unusually stiff leaves when dry, the lateral inflorescences have distinct, oblong foliose bracts and large heads with 10–12 involucral bracts. Its closest relation may be to *P. carpishensis*, which has similar fine hairs on the lower leaf surface, but all parts of the latter are much smaller.

Pentacalia vargasiana (Cabrera) H. Robinson & J. Cuatrecasas, comb. nov. Basionym: *Gynoxys vargasiana* Cabrera, Revista Universidad Nacional Cuzco 33(87): 121. 1944 (1945). TYPE: Peru. Cuzco: Prov. Calca, alrededores de Lares, 3,200 m, *Vargas 3598* (LP).

A recent collection of the species has been seen: Peru. Cuzco: 9–12 km NE of Paucartambo, 2,980–3,050 m alt., shrub 2 m, *Gentry, Dillon, Berry & Aronson 23422* (MO, US). The species was originally placed in *Gynoxys* because of the opposite leaves, in spite of the blunt tips on the style branches. The tails of the anthers are only about a fourth as long as the collar, shorter than those of most members of the subgenus.

KEY TO THE SPECIES OF *PENTACALIA* SUBG. *PENTACALIA* IN PERU (INCLUDING *SENECIO PANTICALLENSIS*, WHICH WAS INCLUDED BY CABRERA, 1985)

1a. Leaves opposite.
  2a. Vines; leaves glabrous; involucres with ca. 8 bracts; rays lacking ..... *P. wurdackii* (J. Cuatrecasas) J. Cuatrecasas
  2b. Shrubs; leaves pubescent; involucres with ca. 13 bracts; rays present.
    3a. Bases of leaf blades narrowly cordate, undersurfaces of leaves lanate with fulvous hairs mostly on veins, margins denticulate with sometimes remote teeth; without persistent enlargements on nodes at bases of petioles ..... *P. vargasiana* (Cabrera) H. Robinson & J. Cuatrecasas
    3b. Bases of leaf blades rounded to short-acute, undersurfaces covered with grayish tomentum, margins denticulate with very close-set small teeth; nodes appearing enlarged by persistent enlarged bases of petioles ..... *P. balsasana* J. Cuatrecasas & H. Robinson
1b. Leaves alternate.
  4a. Heads sessile or subsessile, usually clustered, peduncles not more than 2 mm long.
    5a. Heads with ligulate ray florets.
      6a. Involucre with 8 or 9 bracts; leaves broadly ovate or elliptical, glabrous ..... *P. psidiifolia* (Rusby) J. Cuatrecasas
      6b. Involucre with 11–13 bracts; leaves ovate-lanceolate.
        7a. Leaf blades woolly or glabrescent below ..... *P. brittoniana* (Hieronymus) J. Cuatrecasas
        7b. Leaf blades glaberrimous ..... *P. miguelii* (J. Cuatrecasas) J. Cuatrecasas
    5b. Heads disciform, with florets all tubular, with or without peripheral female florets.
      8a. Leaf blades densely and persistently tomentose below.
        9a. Leaf blades entire; white-tomentose below.
          10a. Leaf blades with evanescent arachnoid tomentum above ..... *P. tarapotensis* (Cabrera) J. Cuatrecasas
          10b. Leaf blades glabrous above ..... *P. marinii* (Cabrera) J. Cuatrecasas
        9b. Leaf blades with mucronate-denticulate margins.
          11a. Involucral bracts glabrescent; leaf blades white-tomentose below ..... *P. herzogii* (Cabrera) J. Cuatrecasas
          11b. Involucral bracts tomentose; leaf blades with ochraceous tomentum below.
            12a. Branches of inflorescence retroflexed .... *P. oronocensis* (DC.) J. Cuatrecasas
            12b. Branches of inflorescence laterally spreading or ascending ..... *P. megaphlebia* (Greenman & J. Cuatrecasas) J. Cuatrecasas
      8b. Leaf blades glabrous or with arachnoid hairs or sparse hairs.
        13a. Leaves with rounded and abruptly short-mucronulate tips ..... *P. mucronatifolia* H. Robinson & J. Cuatrecasas
        13b. Leaves with subacute to acute or acuminate tips.
          14a. Heads with peripheral, tubular, female florets.

15a. Undersurface of leaf blades woolly with white arachnoid hairs; involucral bracts 8–13, ca. 5 mm long ... *P. subglomerosa* (Greenman) J. Cuatrecasas
15b. Undersurface of leaf blades essentially glabrous; involucral bracts 8, 3.5–4.0 mm long.
16a. Leaf blades elliptical to oblanceolate; heads sessile ..... *P. loretensis* (J. Cuatrecasas) J. Cuatrecasas
16b. Leaf blades ovate-lanceolate to lanceolate; heads shortly pedunculate ..... *P. divisoria* (Cabrera) J. Cuatrecasas

14b. Heads without peripheral female florets, all florets bisexual.
17a. Achenes villous with setulae ..... *P. comarapensis* (Cabrera) J. Cuatrecasas
17b. Achenes glabrous.
18a. Involucres with ca. 13 bracts ..... *P. huallagana* (J. Cuatrecasas) J. Cuatrecasas
18b. Involucres with 8 or 9 bracts.
19a. Inflorescence elongate, often with a distinctly zigzagged axis; involucre 3.5–5.0 mm high.
20a. Involucre 3.5–4.0 mm high ..... *P. urubambensis* (Cabrera) J. Cuatrecasas
20b. Involucre ca. 5 mm high ..... *P. sailapatensis* (J. Cuatrecasas) J. Cuatrecasas
19b. Inflorescence condensed, about as wide as long, with essentially straight axis; involucre less than 3.5 mm high.
21a. Leaf blades essentially smooth on upper surface ..... *P. jalcana* (J. Cuatrecasas) J. Cuatrecasas
21b. Leaf blades with close reticulum of raised veinlets on both surfaces ..... *P. pomacochana* (J. Cuatrecasas) J. Cuatrecasas

4b. Heads pedunculate, peduncles mostly 2–30 mm long.
22a. Heads homogamous, with all florets bisexual.
23a. Inflorescences terminal on leafy stems ..... *P. chachapoyensis* (Greenman) J. Cuatrecasas
23b. Inflorescences mostly or completely lateral from axils of vegetative leaves.
24a. Leaf margins denticulate, surfaces nearly smooth ..... *P. huamaliensis* (Cabrera) J. Cuatrecasas
24b. Leaf margins entire; reticulum of veinlets raised above surfaces.
25a. Leaf blades coriaceous, glabrous, broadly ovate, 7.5–9.5 cm wide; heads numerous in ovate-paniculate inflorescences ca. 30 cm long ..... *P. asplundii* (Cabrera) J. Cuatrecasas
25b. Leaf blades herbaceous to subcoriaceous, with some pubescence below, 3.0–5.5 cm wide; heads in racemose or narrowly thyrsoid inflorescences.
26a. Bases of leaf blades subrotund; involucral bracts ca. 7 mm long; heads with ca. 20 florets ..... *P. lucidissima* (J. Cuatrecasas) J. Cuatrecasas
26b. Bases of leaf blades acute; involucral bracts 4.5–5.0 mm long; heads with ca. 12 florets ..... *P. cutervonis* sp. nov.

22b. Heads heterogamous, with peripheral tubular or ligulate female florets.
27a. Involucres with 10–13 bracts.
28a. Inflorescences mostly lateral from axils of full-sized vegetative leaves, with reduced bracts.
29a. Leaf blades broadly ovate, 10–14 cm wide; secondary veins prominent on lower surface ..... *P. todziae* H. Robinson & J. Cuatrecasas
29b. Leaf blades oblong-elliptical, 4–5 cm wide; secondary veins not prominent below.
30a. Undersurfaces of leaf blades and outer surfaces of involucral bracts with hairs; stems broadly fistulose ..... *P. carpishensis* (J. Cuatrecasas) J. Cuatrecasas
30b. Undersurfaces of leaf blades and outer surfaces of involucral bracts glabrous; stems not or scarcely fistulose ..... *P. poyasensis* (J. Cuatrecasas) J. Cuatrecasas
28b. Inflorescences terminal on leafy stems, only lowest branches from axils of scarcely reduced leaves.
31a. Heads disciform to subradiate ... *P. purpurivenosa* (J. Cuatrecasas) J. Cuatrecasas
31b. Heads with distinct ligulate rays.
32a. Leaf margins densely crenulate denticulate; corolla lobes sparsely glanduliferous ..... *P. sagasteguii* H. Robinson & J. Cuatrecasas
32b. Leaf margins entire; corolla lobes glabrous.
33a. Leaf margins broadly recurved ..... *P. tablensis* (Cabrera) J. Cuatrecasas
33b. Leaf margins not or scarcely reflexed.

34a. Leaf blades subcoriaceous, with veinlets raised on surface; tips of pappus bristles slightly more scabrid, not distinctly broadened ..... *P. nunezii* H. Robinson & J. Cuatrecasas
34b. Leaf blades coriaceous, with veinlets obscure; tips of pappus bristles distinctly broadened ..... *P. davidsmithii* H. Robinson & J. Cuatrecasas

27b. Involucres usually with 8–9 bracts.
35a. Involucre 7–12 mm high; leaf margins usually minutely denticulate; veinlets often translucent.
36a. Upper vegetative leaves with auriculate bases .. *Senecio panticallensis* Cabrera
36b. Vegetative leaves without auriculate bases ..... *P. dictyophlebia* (Greenman) J. Cuatrecasas
35b. Involucre 5–7 mm high; leaf margins entire; veinlets not translucent.
37a. Marginal female florets of heads tubular or with limbs only to 2.5 mm long.
38a. Involucres and undersurfaces of leaves tomentose ..... *P. disciformis* (Hieronymus) J. Cuatrecasas
38b. Involucres and undersurfaces of leaves glabrous or essentially glabrous.
39a. Inflorescence a long, narrow, terminal panicle, with many lower branches from axils of scarcely reduced leaves, branches ascending; involucre not turbinate with lower part differentiated at anthesis ..... *P. jelskii* (Hieronymus) J. Cuatrecasas
39b. Inflorescence broadly oval to pyramidal, only about twice as high as wide, with some lower branches from axils of reduced leaves, branches widely spreading; involucre turbinate at anthesis, with lower ⅖ of bracts differentiated ..... *P. maynasensis* H. Robinson & J. Cuatrecasas
37b. Marginal female florets of heads with limbs 4–10 mm long.
40a. Inflorescences lateral from axils of vegetative leaves, individual inflorescences elongate, narrowly thyrsoid to racemiform ..... *P. tillettii* H. Robinson & J. Cuatrecasas
40b. Inflorescences terminal, broadly corymbose to pyramidal.
41a. Branches shortly puberulous in distal part; leaf blades ovate-lanceolate, somewhat fleshy, glabrous; involucral bracts 5–6 mm long, brownish tomentose; inflorescences cymose-corymbose ..... *P. epiphytica* (Kuntze) J. Cuatrecasas
41b. Branches densely reddish hispid; leaf blades ovate, membranaceous, puberulous below; involucral bracts 3–4 mm long, glabrous; inflorescences pyramidal to ovate ..... *P. rufohirsuta* (Cabrera) J. Cuatrecasas

New Species of *Pentacalia* (subg. *Pentacalia*) in Bolivia

Pentacalia (subg. *Pentacalia*) **inquisiviensis** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Bolivia. La Paz: Prov. Inquisivi, on slopes W of Río Glorieta, and along river between mouths of Río Aballahuanta and Río Cayani 7 km S of Choquetanga, 16°54′S, 67°17′W, 3,150–3,550 m, 19 June 1991, *Lewis 38950* (holotype, US; isotype, MO).

In foliis herbaceis oblongo-ellipticis minute denticulatis in nervis puberulis vel tomentellis in inflorescentiis terminalibus patentiter ramosis et in capitulis radiatis longe pedunculatis distincta.

Plants scandent, indefinitely elongate; stems terete, essentially smooth, sparsely minutely puberulous, with solid pith. Leaves alternate, petioles 0.5–1.3 cm long; leaf blades herbaceous, oblong-elliptical, mostly 6–9 cm long, 2–3 cm wide, base narrowly rounded, margins minutely remotely denticulate, apex acute to short-acuminate, upper surface mostly glabrous, minutely puberulous above on impressed major veins, lower surface tomentellous on major veins, very sparsely tomentellous on surfaces; ca. 8 arching secondary veins on each side, raised above surface below, veinlets dark, not raised above surface. Inflorescence terminal, broadly rounded-corymbose to pyramidal, as broad as high or broader, branches and branchlets widely spreading, lower branches from axils of reduced leaves; bracts of upper axis and branches narrowly lanceolate to linear, 5–15 mm long; peduncles 1.5–4.0 cm long, minutely puberulous. Heads 10–12 mm high, heterogamous, radiate; 7 or 8 calycular bracts narrowly lanceolate to linear, 3–5 mm long, sparsely puberulous; involucral bracts ca. 13, puberulous outside, ca. 6 mm long, 2 mm wide, short-acute. Ray florets 10–12; corollas yellow, glabrous, tube ca. 4 mm long, limb 18–19 mm long, ca. 4 mm wide. Disk florets ca. 20; corollas yellow, glabrous, 9.0–9.5 mm long, tube ca. 4 mm long, throat ca. 4.5 mm

long, lobes 1.3–1.5 mm long, ca. 0.8 mm wide, tips somewhat thickened, papillose outside with narrow cells; anther thecae 2.5–3.0 mm long, basal tails one-third to half as long as collar; apical anther appendage oblong, 0.5–0.6 mm long, 0.22 mm wide. Achenes immature, ca. 4 mm long, glabrous; pappus bristles ca. 8 mm long, tips broadened and more scabrid, with inflated, bluntly pointed apical cells. Pollen grains ca. 40 μm diam.

The locality of this species is described as a *Weinmannia–Hesperomeles* forest with *Alnus* predominant along the river. The new species keys to *Senecio yungasensis* Britton in the key by Cabrera (1985), and it resembles Cabrera's illustrations. The Britton species does not seem closely related, having glandular-pubescent stems, upper leaves sessile or subsessile, leaf margins serrate, branches of the inflorescence racemose, and limbs of the rays only ca. 7 mm long. The inflorescence of the new species is one of the most lax with the longest peduncles in the genus. The calycular bracts are larger and more numerous than those of the Ecuadorian and Peruvian species listed above, but are not as prominent as those of the following species.

Pentacalia (subg. *Pentacalia*) **lewisii** H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Bolivia. La Paz: Prov. Inquisivi, "Pavionani," on slope above Pavionani fork of Río Chimu below headwater divide with Río Janko Kalani, area 7 km N of Choquetanga, 16°48′S, 67°18′W, 3,700–3,750 m, 9 Apr. 1991, *Lewis 38520* (holotype, US; isotype, MO).

In foliis carnosis ovatis integris glabris in inflorescentiis terminalibus in capitulis mediocriter longe pedunculatis 10–12 mm altis et longe radiatis distincta.

Plants scandent, indefinitely elongate; stem terete to slightly pentagonal, minutely puberulous, not or scarcely fistulose. Leaves alternate, petioles 0.5–1.0 cm long; blades thickly carnose, glabrous, ovate, 2.5–5.0 cm long, 1.5–2.7 cm wide, base obtuse to short-acute, margins entire, apex obtuse to acute, lower surface slightly paler; secondary veins and veinlets indistinct. Inflorescences terminal, broadly corymbose, flat-topped to slightly convex, longer lower branches from axils of full-sized leaves; peduncles 0.8–3.0 cm long, thinly brownish tomentellous. Heads 10–12 mm high, heterogamous, radiate; 6–8 calycular bracts narrowly lanceolate to linear, 7–12 mm long, often longer than involucral bracts; involucral bracts ca. 13, with sparse arachnoid hairs outside, ca. 7 mm long, 1.5–2.0 mm wide, acute. Ray florets ca. 12; corollas yellow, tube ca. 5.5 mm long, limb ca. 8.5 mm long, ca. 2.5 mm wide. Disk florets ca. 35; corollas yellow, glabrous, ca. 9.5 mm long, tube ca. 4 mm long, throat ca. 4.5 mm long, lobes ca. 1.3 mm long, 0.8 mm wide, tip somewhat thickened with nearly smooth, hardened outer surface; anther thecae ca. 3 mm long, with basal tails one-third to half as long as collar; apical anther appendage ca. 0.6 mm long, 0.3 mm wide. Achenes submature, ca. 2 mm long, glabrous, ca. 6-ribbed; pappus bristles 7–8 mm long, tips not or scarcely broadened, with apical cells slightly more projecting. Pollen grains ca. 37 μm diam.

The new species keys to *Pentacalia tablensis* in the key by Cabrera (1985), but the latter has elliptic rather than ovate leaf blades, distinctly recurved leaf margins, and less numerous, short calycular bracts.

Paratypes. BOLIVIA. **La Paz:** Prov. Inquisivi, "Aguas Calientes de Calachaca," in the area of thermal springs of the Río Calachaca Jahuira, 9 km NW of Choquetanga, 16°48′S, 67°19′W, 3,450–3,500 m, 10 Mar. 1991, *Lewis 38305* (MO, US); same locality as holotype, 9 Apr. 1991, *Lewis 38524* (MO, US). Collection data indicates the fleshy leaves are either folded inward and secund, or folded downward. In one specimen the pistils of the central florets are said to be bright red.

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Liparis seidenfadeniana (Orchidaceae), a New Species from China

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ABSTRACT. *Liparis seidenfadeniana* from China is described, and its relationships are briefly discussed.

Liparis (sect. *Coriifoliae*) **seidenfadeniana** Szlachetko, sp. nov. TYPE: China. Kouy-Tcheou (Guizhou), San-chouen (Sichuan), *Cavalerie 3792* (holotype, P; isotype, P). Figure 1.

Species haec *Liparis inapertae* affinis, sed gynostemiis alatis, foliis obovatis, pseudobulbis anguste cylindricis procumbentisque et inflorescentis brevis, 1–2(–3)-floris iam diagnoscenda.

Rhizome creeping. Pseudobulbs narrowly cylindrical, up to 10 mm long, 2 mm diam. Leaf solitary, subsessile, obovate, obtuse, up to 25 mm long, usually less than 10 mm, about 5–8 mm wide, hard.

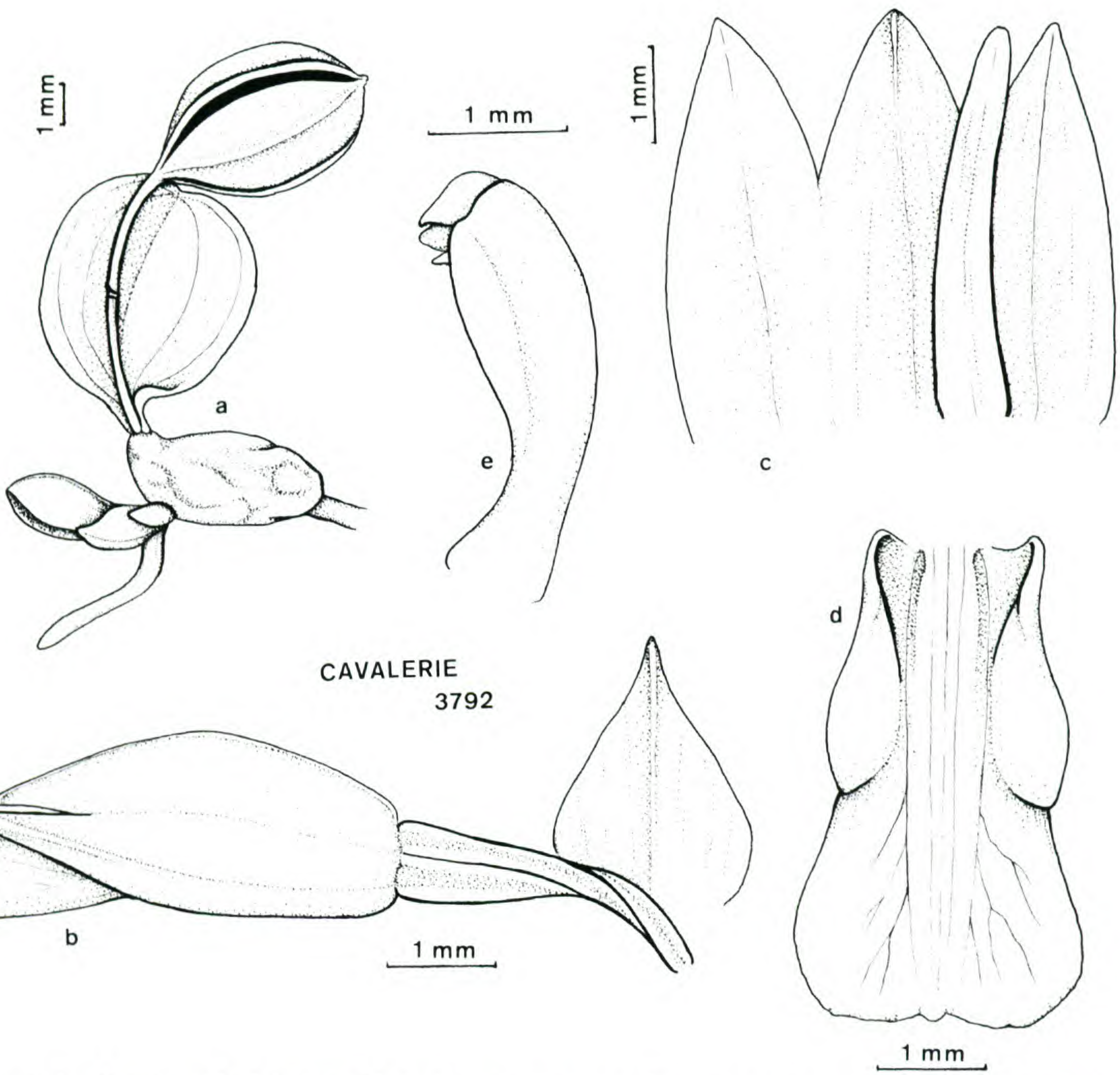

Figure 1. *Liparis seidenfadeniana* Szlachetko. —a. Plant. —b. Flower and floral bract. —c. Sepals and petals. —d. Lip. —e. Column, side view. Drawn from the holotype (P).

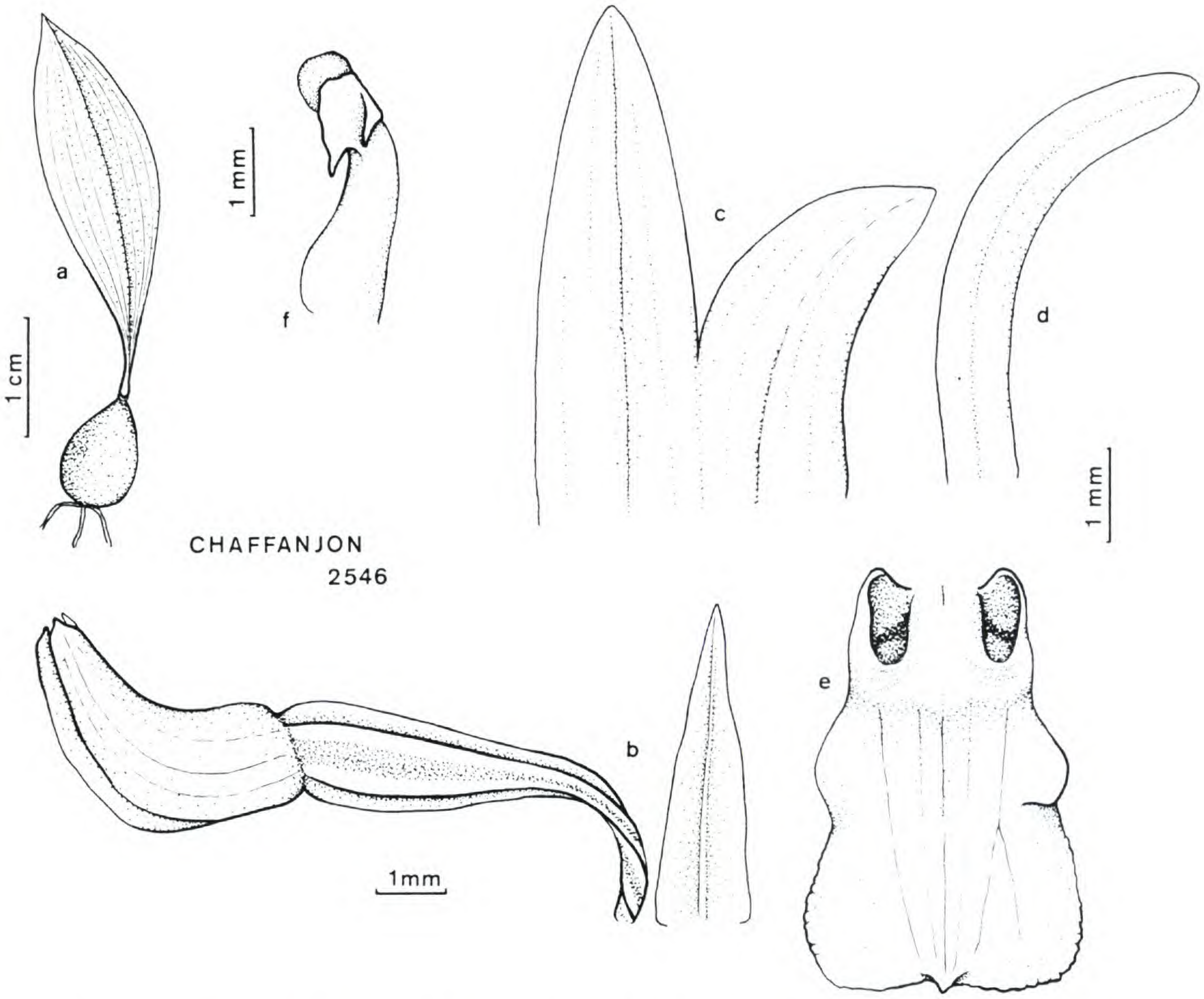

Figure 2. *Liparis inaperta* Finet. —a. Plant. —b. Flower and floral bract. —c. Sepals. —d. Petal. —e. Lip. —f. Column, side view. Drawn from the holotype (P).

Inflorescence up to 15 mm long, usually 1–2-, occasionally 3-flowered. Floral bracts ovate-triangular, about 3 mm long, membraneous. Flowers tiny, tubular, ± straight. Pedicel and ovary 3–4 mm long. Dorsal sepal oblong-ovate, acute, 4.5 mm long, 1.5 mm wide; on margins fused ⅔ of their length with the lateral sepals. Lateral sepals free from one another, oblong-lanceolate, acute, asymmetric, 4.5 mm long, 1.3 mm wide. Petals linear, slightly falcate, obtuse, 4.5 mm long, 0.5 mm wide, adnate to the sepals. Lip ± straight, ± rectangular in outline, 4.5 mm long, 2.5–2.8 mm wide, fleshy; basal part with small auricles, thickened on margins and along midnerve; apical part thin, minutely retuse. Column slightly arcuate, 3 mm long, without wings or auricles. Anther cordate, operculate, 0.7 mm long. Pollinia 4, ca. 0.5–0.6 mm long, laterally flattened, narrowed toward apex.

Liparis seidenfadeniana is closely related to *L. inaperta* Finet (Fig. 2) and *L. fargesii* Finet (Fig. 3), both from China. From *L. inaperta* it is easily distinguished by the lack of column wings, straight flowers, a short and sparse inflorescence, obovate leaves, and narrowly cylindrical pseudobulbs. It differs from *L. fargesii* by tubular flowers, connate sepals, acute apical portion of lip, and obovate leaves. Information about the type locality given by Cavalerie on the original label is very unclear. It includes just the names of two Chinese provinces without more precise locality data.

This species is named after Gunnar Seidenfaden, an eminent specialist of the orchid flora of Indochina.

Acknowledgments. I am grateful to the curator of P for hospitality during my personal visits and Ryszard Ochyra for the translation of the Latin diagnosis.

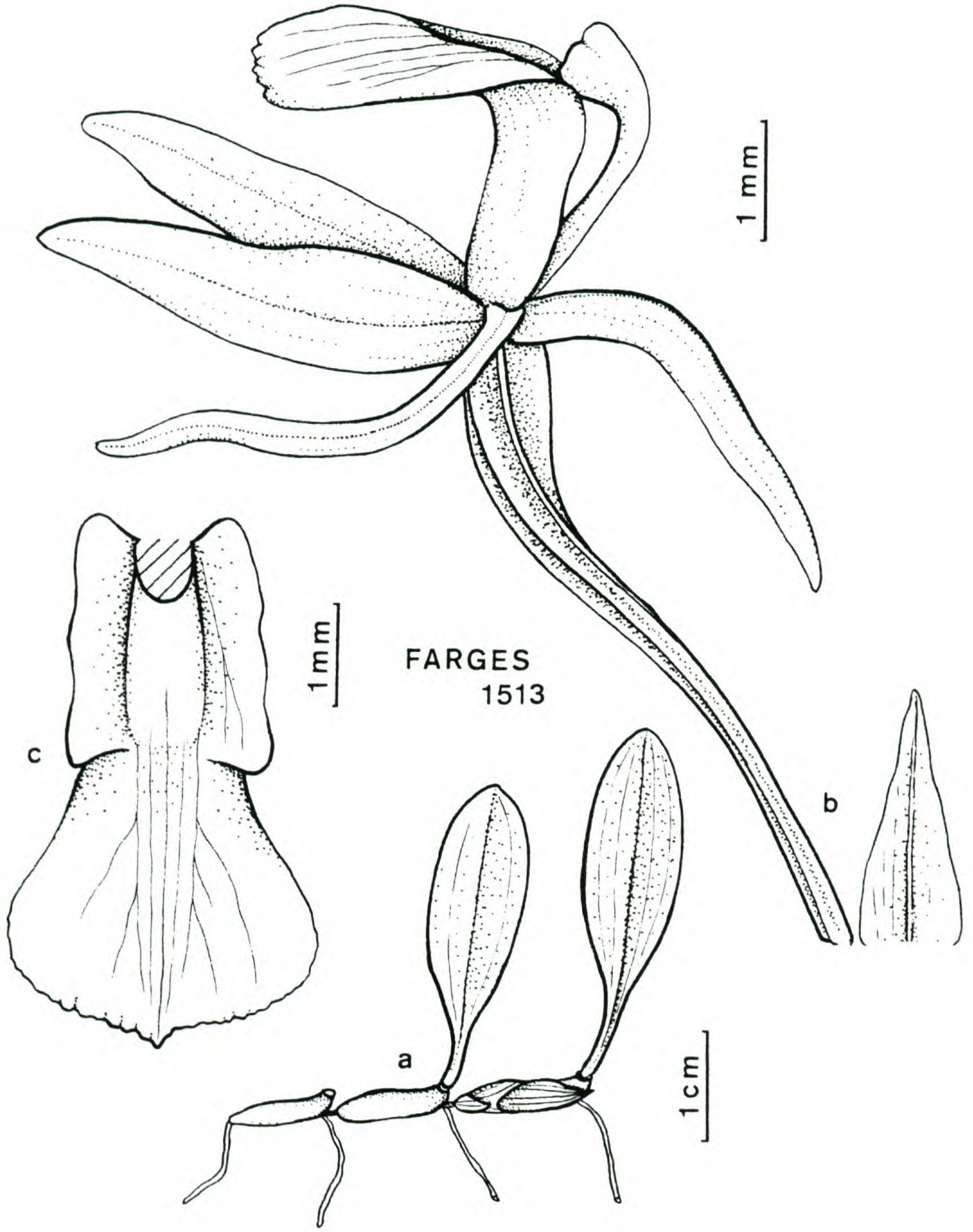

Figure 3. *Liparis fargesii* Finet. —a. Plant. —b. Flower and floral bract. —c. Lip. Drawn from the holotype (P).

A New Combination for a North American Lycopod

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ABSTRACT. The new combination *Phlegmariurus dichotomus* (Jacquin) W. H. Wagner is needed following recent revision of *Lycopodium* sensu lato, based on morphological and cytological characters.

The generic classification of *Lycopodium* sens. lat. has recently been revised on the basis of numerous morphological and cytological characters (Wagner & Beitel 1992, and references therein). All of the most primitive species, usually called firmosses, have been placed in *Huperzia*, a genus that is mainly temperate and arctic, terrestrial, and possesses highly specialized gemmae. In these characteristics, *Huperzia* differs from the mainly tropical, epiphytic, nongemmiferous species assigned to the genus *Phlegmariurus* (Herter) Holub. Only a single member of *Phlegmariurus* is recorded in the *Flora of North America* range. In North America, it occurs only in Florida. Because this species has not been transferred to *Phlegmariurus*, the following combination is made:

Phlegmariurus dichotomus (Jacquin) W. H. Wagner, comb. nov. Basionym: *Lycopodium dichotomum* Jacquin, Enum. Stirp. Vindob. 314. 1762. *Huperzia dichotoma* (Jacquin) Trevisan, Atti Soc. Ital. Sci. Nat. 17: 248. 1874. TYPE: Jacq., Hort. Bot. Vindob. 3: t. 45. 1776 (holotype, BM).

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Agnesia, a New Genus of Amazonian Herbaceous Bamboos (Poaceae: Bambusoideae: Olyreae)

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ABSTRACT. *Agnesia lancifolia* from Amazonian South America is described and illustrated. A table distinguishing the new genus from related taxa is given.

In their revision of the herbaceous bamboo genus *Olyra* L. (Poaceae: Bambusoideae: Olyreae), Soderstrom & Zuloaga (1989) left *O. lancifolia* Mez untreated. Merely noting that the species probably represented a genus different from *Olyra*, they declined to describe it based on the little material available, the only collections having been made in 1901, 1943, 1965, and 1976.

In preparing a treatment of the herbaceous bamboos for the *Flora de Colombia* project, however, it has become necessary to deal with *O. lancifolia*. Based on its inflorescence morphology and distinctive, apiculate female floret, we have chosen, following the suggestion of the late Thomas R. Soderstrom, to describe it as yet another segregate of *Olyra*, especially since no new and better collections have been forthcoming over the last 16 years.

Agnesia is distinguished from all other olyroid grasses by its combination of the following characters: reduced, racemelike panicles at the upper nodes, usually with a single terminal female and several subterminal male spikelets; female spikelets with caudate, 3–5-nerved glumes; and ellipsoidal, pubescent, female florets, with the apex prolonged into an abrupt, slender, short-pilose mucro. This short-awned female floret is particularly noteworthy and separates the new genus from any other olyroid grass except *Buergersiochloa* Pilger and *Ekmanochloa* A. Hitchcock.

Using Clayton & Renvoize's (1986) key to grass genera, *Agnesia* would key out near *Rehia* Fijten, *Maclurolyra* Calderón & Soderstrom, and *Reitzia* Swallen (Table 1), genera that the authors note are ". . . barely distinct, and not much different from *Olyra* . . . ." However, *Olyra* would become uncomfortably heterogeneous if any of these three genera, or *Agnesia*, were included. All differ from *Agnesia* in their awnless female florets. In addition, *Rehia* differs in its cormose culm bases; male spikelet pedicels longer than the female pedicels; and 1–5 male spikelets below each solitary or paired female spikelet(s). *Maclurolyra* differs in its solitary inflorescence per culm. Using the generic keys in Calderón & Soderstrom (1980), *Agnesia* would key out to *Reitzia*. The latter genus differs, however, in its numerous, often paired female and male spikelets in each inflorescence; cartilaginous female glumes; and glabrous female florets.

Arberella Soderstrom, another olyroid genus, is possibly the closest relative of *Agnesia*. Both genera have inflorescences with a single (rarely several), solitary female spikelet(s) on a clavate pedicel, and have densely silky-hairy female florets. However, *Arberella* differs in the presence of axillary inflorescences at the lower and middle nodes; female glumes often separated from the floret by a distinct internode; the adaxial, proximal portion of leaf blade midnerve terminating in a knoblike swelling; the presence (in some species) of blisterlike callus marks on the culms just below the nodes; and awnless female florets.

Agnesia also shows some similarities to *Olyra amapana* Soderstrom & Zuloaga and *O. juruana* Mez. All three taxa have 1–10 inflorescences borne at the uppermost nodes; subequal female glumes; and a silky-hairy female floret. Furthermore, *O. amapana* has a solitary (or rarely 2–4) terminal female spikelet(s) in each inflorescence. However, these species of *Olyra* differ from *Agnesia* in their more or less strongly asymmetrical leaf blade bases; 7–11-nerved female glumes; and, once again, awnless female florets.

Agnesia Zuloaga & Judziewicz, gen. nov. TYPE: *A. lancifolia* (Mez) Zuloaga & Judziewicz.

TABLE 1. Comparison of *Agnesia* to related genera.

Character	*Arberella*	*Agnesia*	*Maclurolyra*	*Piresia*	*Rehia*	*Reitzia*
Female spikelets/inflorescence	1(several)	1(several)	many	2–4	2–5	5–6
Female glumes awned (+) or not (−)	−	+	−	−	+	−
Female glumes, number of basal nerves	5–11	3–5	3–5(−7)	3–5	7	3–5
Female floret, basal internode present (+) or not (−)	+(−)	−	−	−	−	−
Female floret indument: silky (S) or glabrous (G)	S	S	S	S	S	G
Female floret awned (+) or not (−)	−	+	−	−	−	−
Axillary inflorescences at lower nodes present (+) or absent (−)	+	−	−	−	−	−
Inflorescences on separate culms present (+) or not (−)	−	−	−	+	−	−

Ab omnibus generibus tribus Olyreae a combinatione characterum sequentium optime distincta: panicula reducta, racemoso-paniculata apicem versus, plerumque spicula feminea solitaria, terminali et variis spiculis masculis subterminalibus; floscula feminea glumis 3–5-nerviis; floscula feminea ellipsoidales, pubescentes, apice mucrone gracili, brevi-piloso abrupte producto.

Delicate caespitose, herbaceous perennials. Culms unbranched above the base. Lower and middle leaves bladeless or with minute, erect to reflexed, linear to ovate-lanceolate blades; upper leaves in dense, pinnate-appearing complements of 3–15; sheaths slightly keeled on back, the summit prolonged on one side into a small auricle; inner ligule small, membranous; pseudopetioles present, short; blades linear to lanceolate, flat, cuneate and slightly asymmetrical at the base, acuminate and symmetrical at the apex. Inflorescences several from the uppermost nodes, short-exserted or the bases included in the uppermost leaf sheaths; individual inflorescence a short, racemose panicle, the axis terminating in a clavate pedicel bearing a female spikelet, and several to many subterminal male spikelets (or occasionally several male and female spikelets) borne on erect, filiform pedicels, or occasionally a short, erect branch present in the lower part of the inflorescence, this bearing two male spikelets and often subtended by a minute bract; rachis and pedicels triquetrous. Female spikelets slenderly lanceolate, falling entire or the glumes tardily deciduous; glumes lanceolate-aristate, firmly membranous, caudate, their apices prolonged into stiff, scabrous, scissorslike awns; lower glume 5-nerved, slightly longer than the 3-nerved upper glume; floret deciduous, the lemma shorter than the glumes, ellipsoidal, coriaceous, pale becoming mottled with dark spots, the surface smooth and shiny, covered throughout with appressed, silky hairs, the apex acute, prolonged into an abrupt, slender, short-pilose mucro 1–1.5 mm long; palea nearly concealed by the overlapping margins of the lemma except at the base; flower and fruit not seen. Male spikelets early deciduous, shorter than the female spikelets, linear, hyaline, lacking glumes, the lemma 3-nerved, caudate-acuminate, the palea 2-nerved, acute; flower not seen. Chromosome number unknown.

Agnesia is a rare, monotypic genus of wet, lowland forests in Amazonian South America.

The genus is named in honor of Agnes Chase (1869–1963), outstanding American agrostologist and author of a monumentally complete and useful index of published grass names (Chase & Niles, 1962). Even today, Chase's handwritten notes on specimens and folders in the U.S. National Herbarium often provide welcome hints and time-saving insights into the identities and relationships of many grasses.

Agnesia lancifolia (Mez) Zuloaga & Judziewicz, comb. nov. Basionym: *Olyra lancifolia* Mez, Notizbl. Bot. Gart. Berlin-Dahlem 7: 45. 1917. TYPE: Brazil. Amazonas: ad flumen Juru prope Fortaleza [confluence of Rio Juru and Rio Solimoes, ca. 2°35′S, 65°40′W], Oct. 1901, *E. Ule 5951* (holotype, B not seen, probably destroyed; photograph and fragment of leaf, US; isotype, HBG? not seen). Figure 1.

Figure 1. *Agnesia lancifolia* (Mez) Zuloaga & Judziewicz. —A. Habit of plants from typical populations. —B. Habit of plants from a Pará, Brazil, population. C–G. Female spikelet. —C. Entire spikelet and upper part of pedicel.

Culms 7–10 per clump, erect, 15–50 cm tall, 1 mm diam.; internodes puberulent in lines; nodes flaring, the lower geniculate and at maturity splitting in two, glabrous. Lower and middle leaves bladeless or with minute blades up to 5 mm long; upper leaves with sheaths 20–30 mm long, folded width 2 mm, glabrous on the back, puberulent toward the broad, hyaline margins, the auricle 0.5 mm long, pilose or glabrous; inner ligule 0.3–0.6 mm long, ciliolate; pseudopetiole 1–2 mm long, densely pubescent adaxially, glabrous abaxially; blades (60–)80–160 mm long, (3–)10–30 mm wide, green above, green or purplish below, glabrous, the margins scabrous. Inflorescences 1–6 from the terminal and subterminal nodes, 20–40 mm long, borne on puberulent peduncles up to 80 mm long; individual inflorescences 10–40 mm long, with a terminal (occasionally 3–4) female spikelet(s) and 4–12 subterminal male spikelets, borne on pedicels 0.5–3 mm long, the basal branch up to 5 mm long, its bract to 0.5 mm long. Female spikelets 11–15 mm long; glumes glabrous to puberulent; lower glume 11–18 mm long including an awn 4.5–8 mm long, 5-nerved (or 7–8-nerved toward the apex), the nerves anastomosing, scabrous toward the apex on the inner surface; upper glume 9–15 mm long including an awn 2.5–5 mm long, 3-nerved; floret lanceolate, the lemma 7–8 mm long, 1.7–2 mm wide, covered with hairs ca. 1 mm long. Male spikelets reportedly linear, 7–8 mm long, densely pilose, the lemma prolonged into a flexuous awn 1–2 mm long; flower not seen.

Habitat and distribution. Shaded understory of wet, lowland, terra firme forests of Amazonian Brazil, Colombia, and Peru.

The Prance collection from Pará, eastern Amazonia, which is unfortunately sterile, has narrow, linear leaf blades in complements of 7–15 (Fig. 1B; compared with 3–7 in the other collections, Fig. 1A) and linear blades only 60–80 mm long and 3–4.5 mm wide (compared with 100–160 mm long and 10–30 mm wide in the other collections). More collections may show this very elegant population to be a species separate from *A. lancifolia*.

Additional specimens examined. BRAZIL. **Pará:** 10 km S of Rio Muirapiranga, Rios Pacaj and Muirapiranga, 2°33–50′S, 50°38–50′W, terra firme, 12 Oct. 1965 (sterile), *Prance et al. 1619* (NY, US). COLOMBIA. **Guaviare:** confluence of Río Macaya and Río Ajajú, Puerto Hevea, 300 m, July 1943 (fl), *Grassl 10031a* (GH, US). PERU. **Loreto:** Río Javarí, 2 hours above Javarizinho, forest on terra firme, 24 Oct. 1976 (fl), *Prance et al. 24087* (MO, NY, US).

Acknowledgments. We gratefully acknowledge Vladimiro Dudás for the illustration and Gerrit Davidse and Paul Peterson for help in various ways. The senior author was assisted by a grant from the John Simon Guggenheim Memorial Foundation, which enabled him to visit the Missouri Botanical Garden during 1990. Tarciso Filgueiras provided the Latin diagnosis.

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—D. Lower glume. —E. Upper glume. —F. Floret, dorsal view. —G. Floret, ventral view. —H. Outline of male spikelet. (A, C–G based on *Grassl 10031A*, US; B based on *Prance et al. 1619*, US; H based on an unpublished drawing by Chase from *Ule 5951*, B.)

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Pilocosta (Melastomataceae) Revisited: A New Species, Polyploidy, and the Base Chromosome Number of the Genus

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ABSTRACT. A synoptic review of *Pilocosta* is presented to facilitate identification and comparison of a new species, *P. nubicola*, which is described and illustrated. An original chromosome count of $n = 11$ is reported for this species, together with updated geographic and taxonomic notes and a revised key to the five known species in the genus. Based on an evaluation of recorded chromosome counts, $x = 11$ is established as the base chromosome number of *Pilocosta*.

Pilocosta, one of about 25 genera in the traditionally recognized tribe Tibouchineae, is characterized by its quadrate hypanthia and four-merous flowers that are solitary, axillary, and ebracteate.

In the paper proposing *Pilocosta* as a new genus, Almeda & Whiffin (1981: 310) emphasized the distinctiveness of two collections from Costa Rica's Cordillera de Tilarán that appeared to be related to *P. erythrophylla*. My subsequent fieldwork has yielded additional material of this rare and little-collected *Pilocosta*. Analysis of this material and a study of meiotic chromosomes now provide compelling evidence for formal recognition of this entity as a new species described here as *P. nubicola*. To facilitate identification and comparison, it is presented in the context of a brief synopsis with a revised key to the five known species of *Pilocosta*, a discussion of the base chromosome number of the genus, and updated taxonomic and geographic notes.

The Base Chromosome Number of *Pilocosta*

The gametic chromosome number is reported here for *P. nubicola*. Meiosis was regular with 11 bivalents at diakinesis in all cells examined (Fig. 1A, B). Bud material for this count was collected from a natural population in the field, fixed in modified Carnoy's (Bradley, 1948) solution (4 chloroform, 3 ethanol, 1 glacial acetic acid, v/v/v/), and stored under refrigeration. Counts were made using a Zeiss light microscope with phase contrast and a 100× oil immersion objective. Drawings of meiotic figures were made with camera lucida at a magnification of 2100×. The type collection is the voucher for this count.

With this report, chromosome numbers are now known for all described species of *Pilocosta*. A count of $n = 11$ for *P. nubicola* is in agreement with records for *P. campanensis* (Almeda, 1989) and a Panamanian population of *P. oerstedii* (Almeda & Chuang, unpublished). It is now clear that *P. nana*, with populations having $n = 22$ (Almeda & Chuang, unpublished) and $n = 33$ (Almeda & Whiffin, 1981), consists of tetraploid and hexaploid races, respectively, based on $x = 11$. The occurrence of $n = 11$ or multiples of this number in four of the five species of *Pilocosta* leaves no doubt that $x = 11$ is the basic chromosome number in the genus. Both $n = 7$ and $n = 14$ were reported for *P. erythrophylla* (Almeda & Whiffin, 1981). We can now disregard $n = 7$ as a possible base number in *Pilocosta*. Of the more than 420 species of Melastomataceae for which chromosome counts are available, only 13 have numbers lower than $n = 9$. These lower numbers occur in a diverse assemblage of specialized species, which suggests that they have been derived from an ancestral diploid taxon by descending dysploidy.

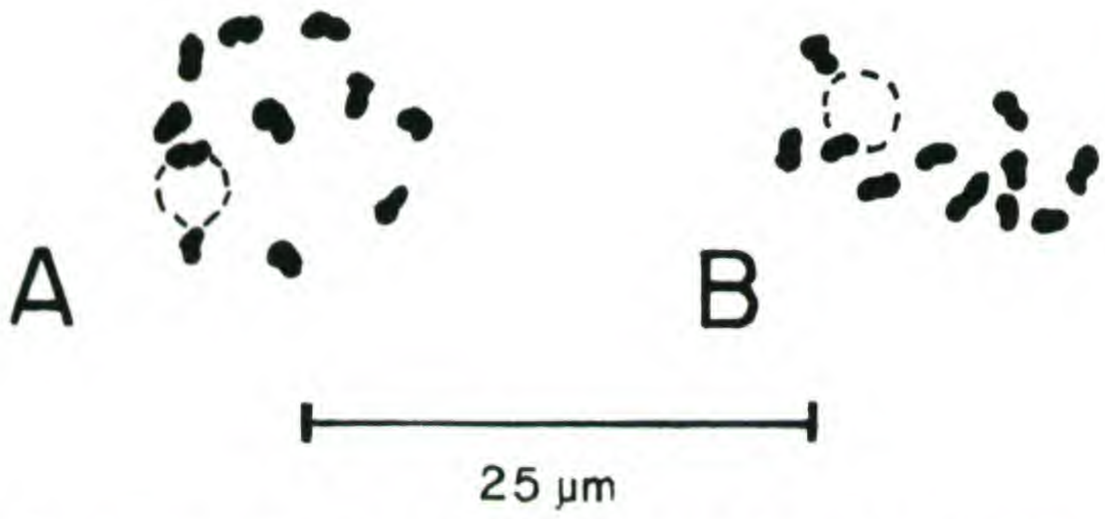


Figure 1. Camera lucida drawing of meiotic chromosome figures. —A, B. *Pilocosta nubicola*, $n = 11$, diakinesis (*Almeda & Daniel 7065*).

A chromosome count of $n = 18$ for two Costa Rican populations of *Pilocosta oerstedii* (Almeda & Whiffin, 1981) is the most enigmatic report to date because a single count from a Panamanian population is $n = 11$. It is tempting to speculate that $n = 18$ may have originated as a dysploid derivative of an ancestral tetraploid population with $n = 22$. Alternatively, dysploid reduction from $n = 11$ to $n = 9$, followed by polyploid gain, would also account for the origin of $n = 18$.

With haploid chromosome numbers of $n = 7$, 11, 14, 18, 22, and 33, *Pilocosta* is remarkably diverse for a genus of its size. Chromosome information has been a helpful source of data in circumscribing species. It is also useful in corroborating the generic distinctiveness of *Pilocosta*. *Tibouchina*, the genus to which described species of *Pilocosta* were assigned prior to 1981, is characterized by $x = 9$ (Almeda & Chuang, 1992). Although no species of *Pilocosta* has $n = 9$, the suggestion that this be considered a prime number in any attempt to make phylogenetic inferences in the genus (Almeda & Whiffin, 1981) is now untenable. This hypothesis was based on the observed frequency of $x = 9$ in genera of Tibouchineae then known cytologically and the report of $n = 18$ for *P. oerstedii*.

Almeda & Whiffin (1981) also commented on the intraspecific polyploidy in *P. erythrophylla*, noting that differences in ploidal levels could not be correlated with morphological, ecological, or geographical differences. This observation can now be extended to the polyploid races of *P. nana* and may also apply to *P. oerstedii*.

Although two species of *Pilocosta* have retained the base chromosome number of 11, polyploidy and dysploidy clearly have played a role in cytoevolution of the other three species. In the species of *Pilocosta* with more than one cytotype, a pattern emerges in which chromosomal evolution is evidently promoting reproductive isolation but preceding any significant morphological differentiation.

Key to the Species of *Pilocosta*

1a. Principal leaves 12–40(–48) mm long, sparsely to copiously pubescent on both surfaces, innermost pair of lateral primary veins diverging from the midvein (1–)1.5–8 mm above blade base; calyx lobes on fruiting hypanthia 3–7 mm long (excluding apical setae).
  2a. Plants distinctly woody; stamens differing markedly in posture, size, and coloration, stamens of the larger (antesepalous) whorl geniculate at the filament insertion, connective prolonged 1.5–3 mm below anther thecae.
    3a. Hypanthia densely pilose to sericeous on the four prominent angles, otherwise glabrous, the trichomes soft, smooth, and silky to touch; Costa Rica and western Panama .... 5. *P. oerstedii*
    3b. Hypanthia moderately setulose on and between the four prominent angles, the trichomes rigid, minutely barbed or roughened apically and bristly to touch; central Panama ..... 1. *P. campanensis*
  2b. Plants herbaceous; stamens differing somewhat in size but similar in posture and coloration, stamens of the larger (antesepalous) whorl ± erect or ascending but not strongly geniculate at the filament insertion, connective prolonged 0.25–0.5 mm below anther thecae.
    4a. Abaxial foliar surface and hypanthium uniformly red in color; fruiting hypanthium 7–8 mm long on pedicels 5–9 mm long, pubescent only on the four prominent angles ... 4. *P. nubicola*
    4b. Abaxial foliar surface and hypanthium typically green (occasional individuals have some leaves with an irregular flush of pigmentation); fruiting hypanthium 9–13 mm long on pedicels (6–)9–20 mm long, pubescent on and between the four prominent angles ..... 3. *P. nana*

1b. Principal leaves 2–13 mm long, moderately to densely pubescent on the upper (adaxial) surface but essentially glabrous on the lower (abaxial) surface or with scattered trichomes largely restricted to the elevated primary veins, innermost pair of lateral primary veins diverging from the midvein 0.5–1 mm above blade base; calyx lobes on fruiting hypanthia 1–3 mm long (excluding apical setae) ..... 2. *P. erythrophylla*

Synopsis of *Pilocosta*

1. Pilocosta campanensis (Almeda & Whiffin) Almeda, Proc. Calif. Acad. Sci. 46: 219. 1989. Basionym: *Pilocosta oerstedii* (Triana) Almeda & Whiffin subsp. *campanensis* Almeda & Whiffin, Syst. Bot. 5: 306. 1980 [1981]. TYPE: Panama. Panamá: Cerro Campana, 10 Dec. 1967, *Lewis et al. 3069* (holotype, MO; isotypes, COL, DUKE, F, K, NY, UC).

This species is endemic to west-central Panama where it occurs in the provinces of Coclé, Herrera, and Panamá at 300–1,100 m. In habit and androecial morphology *Pilocosta campanensis* is most similar to *P. oerstedii*. These two species displace one another geographically, with *P. campanensis* typically occurring in wetter sites and at lower elevations.

2. Pilocosta erythrophylla (Gleason) Almeda & Whiffin, Syst. Bot. 5: 309. 1980 [1981]. Basionym: *Tibouchina erythrophylla* Gleason, Phytologia 1: 133. 1935. TYPE: Costa Rica. Heredia: Yerba Buena, Feb. 1926, *Standley & Valerio 49048* (holotype, US; photograph, NY).

This species appears to be restricted to perpetually wet habitats. It occurs in a relatively small area of Costa Rica's Cordillera Central on the slopes and valleys between Volcán Barva and Cerro Zurquí, extending to the lower western slopes of Volcán Irazú at 1,480–2,000 m.

Within its limited range, *P. erythrophylla* has populations with $n = 7$ and $n = 14$. A more extensive series of counts is needed to determine whether diploids outnumber the tetraploids or vice versa. This species is somewhat variable in internode length and leaf size, but pollen samples for plants from both chromosomal races have a mean diameter of 15.9 μm.

3. Pilocosta nana (Standley) Almeda & Whiffin, Syst. Bot. 5: 307. 1980 [1981]. Basionym: *Chaetolepis nana* Standley, Field Mus. Nat. Hist., Bot. Ser. 4: 247. 1929. TYPE: Panama. Bocas del Toro: region of Almirante, Jan.–Mar. 1928, *Cooper 233* (holotype, F; photograph, NY).

Pilocosta nana has the most widespread geographic and elevational range of any species in the genus. It is known from Volcán Arenal in north-central Costa Rica south to the Cordillera Central extending disjunctly to western and central Panama, northern Colombia (Magdalena), and northern Ecuador (Pichincha) at 450–2,000 m. The single collection from Ecuador was made in 1984 at 800 m (*Betancourt 119*, US).

This is the only species that occasionally grows sympatrically with other congeners. I have found it growing with *P. erythrophylla* in Costa Rica and with *P. campanensis* and *P. oerstedii* in Panama. The differing chromosome numbers between *Pilocosta nana* and each of the above-mentioned taxa probably account for the lack of intergradation where they grow together.

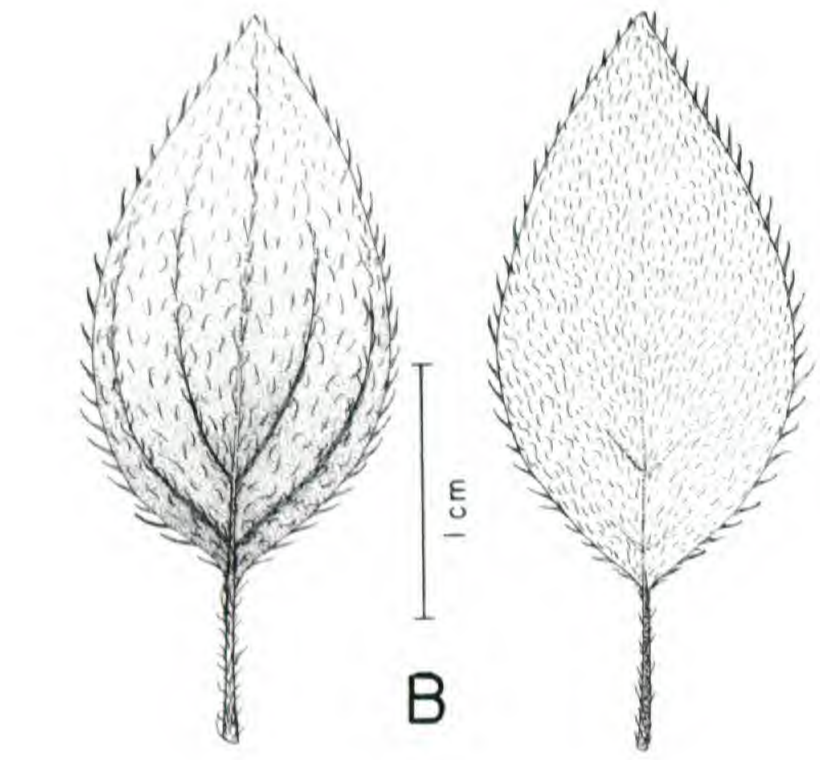
Pilocosta nana is also the most variable species in the genus. Chromosome counts for most populations analyzed to date are hexaploid with $n = 33$, but one tetraploid population with $n = 22$ has recently been collected in the Cerro Colorado region of western Panama. The different ploidal levels of *P. nana* are indistinguishable morphologically except that there appears to be a tendency for the tetraploid to have hypanthia that are more sparsely pubescent to glabrate between the four angles.

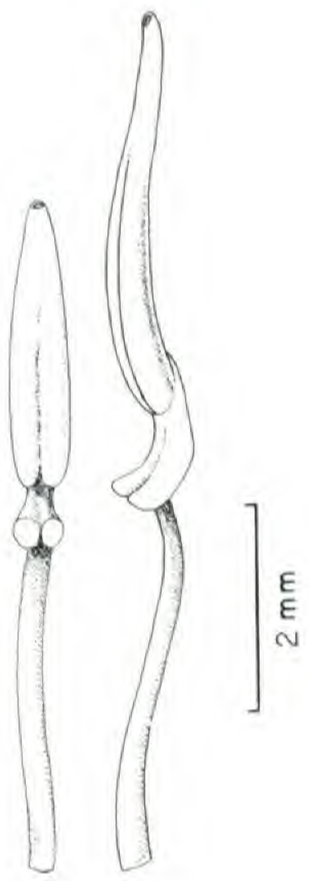
In terms of leaf size, hypanthial length, and pollen diameter (mean 27.8 μm; range 25.9–30.5 μm), *P. nana* exhibits the classic "gigas" syndrome associated with the polyploid condition. Its comparatively broad geographic and elevational range also lends support to the postulate that chromosome doubling may propel a population into a new adaptive sphere, rendering it capable of occupying habitats beyond the limits of its diploid progenitor (Levin, 1983; Lewis, 1980).

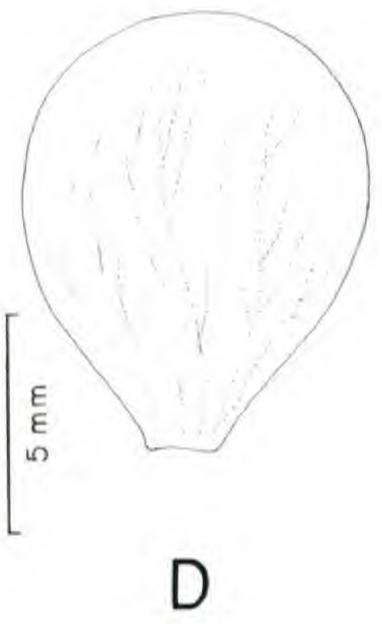
4. Pilocosta nubicola Almeda, sp. nov. TYPE: Costa Rica. Alajuela: Cordillera de Tilarán, Monteverde Cloud Forest Reserve, continuation of El Camino into the Peñas Blancas valley, 25 Feb. 1992 (fl, fr), *Almeda & Daniel 7065* (holotype, CAS; isotypes, CR, MO, US). Figure 2.

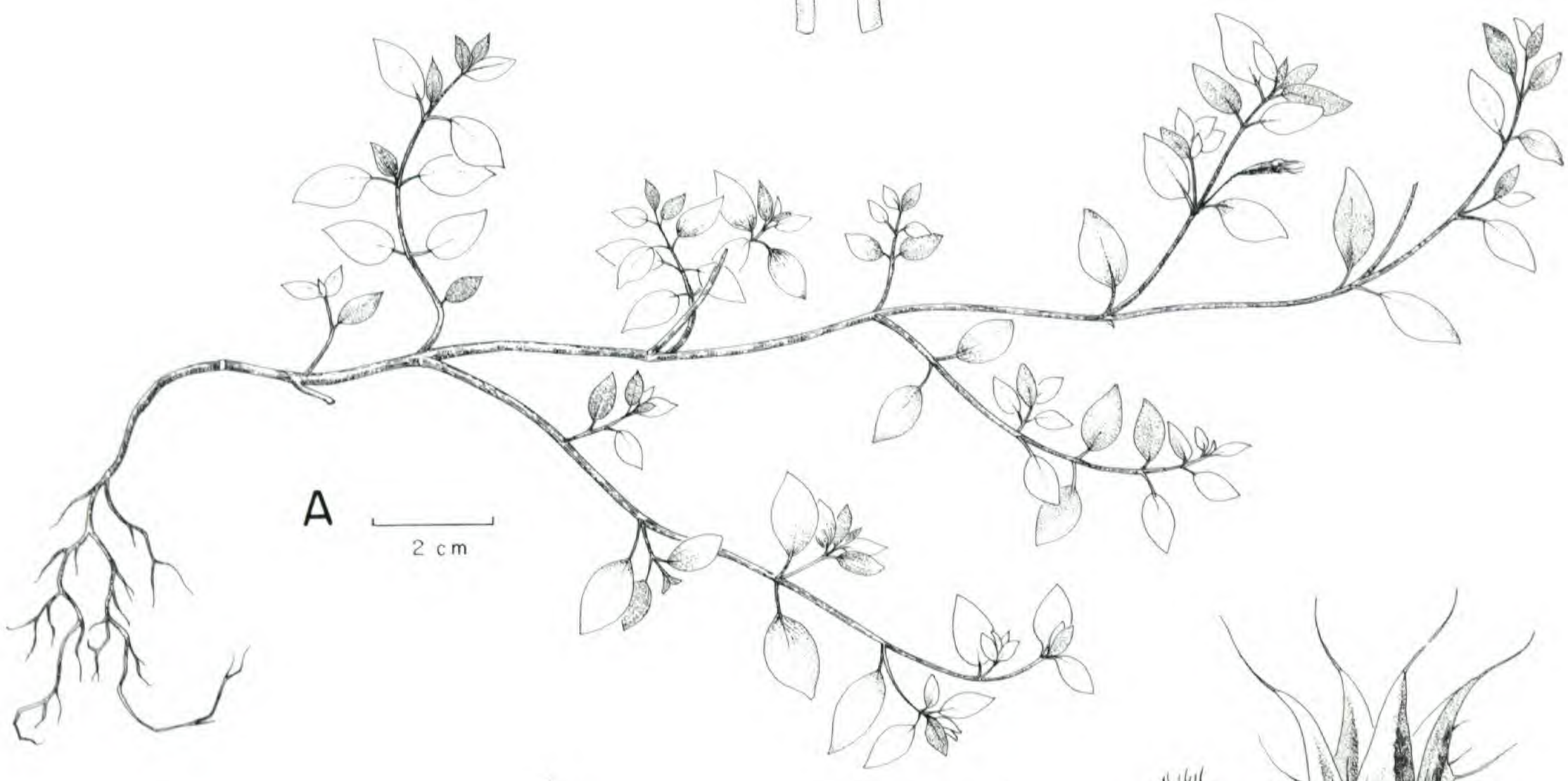
Herbae perennes, caules diffusi prostrati ramosi gracillimi, 4-angulati, demum subteretes, ad angulos sparse vel modice pubescentes pilis curvato-adscendentibus. Petioli 2–7 mm longi; lamina 12–26 × 8–18 mm ovata vel elliptico-ovata, apice acuta basi obtusa vel rotundata, supra dense vel modice albo-villosa, subtus rubra, sparse vel modice strigosa, 5–7-plinervata. Flores 4-meri, pedicellati et ebracteati in foliorum superiorum axillus solitarii. Hypanthium (ad torum) 7–8 × 2.5 mm, quadrangulare et manifeste 4-costatum, inter angulos glabrum et ad angulos sparse vel modice pubescens pilis curvato-adscendentibus; calycis lobi 3 × 2 mm anguste oblongo-triangulares persistentes. Stamina dimorphica; antherarum thecae subulatae apice uniporoso poro ventraliter inclinato. Connectivo ad basim 0.25 vel 0.5 mm prolongato et ventraliter bilobulato. Ovarium 4-loculare apice modice setoso. Semina ca. 0.5 mm longa. Chromosomatis numerus: $n = 11$.

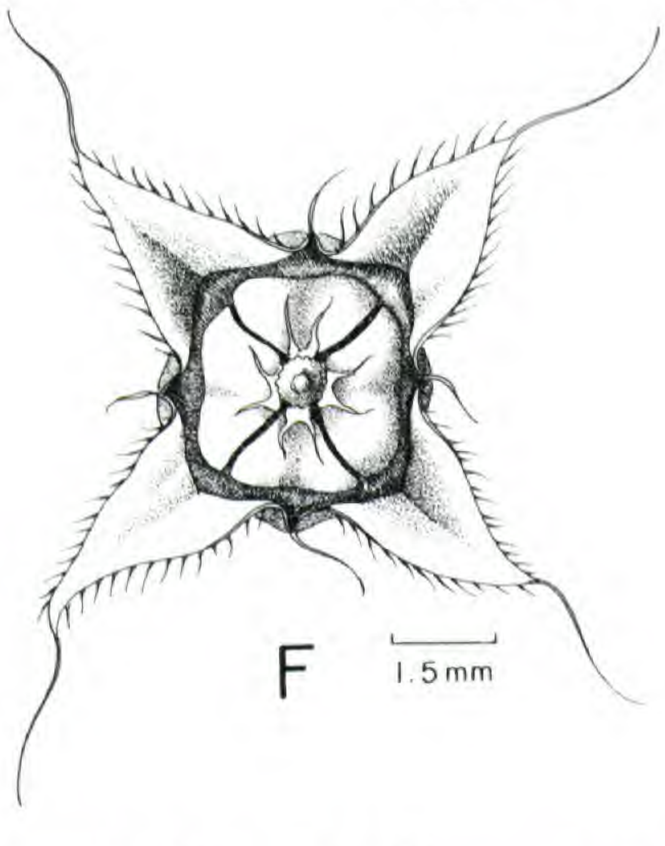
Prostrate matting herb commonly rooting at nodes with trailing branches to 5 dm long. Cauline internodes quadrate to rounded-quadrate, sparsely to moderately covered with ascending or incurved, minutely barbellate multicellular trichomes on stem angles but sparingly pubescent to glabrate between the angles. Mature leaves equal to somewhat unequal in size in each pair; petioles 2–7 mm long, 0.5 mm wide; blades chartaceous when dry, entire











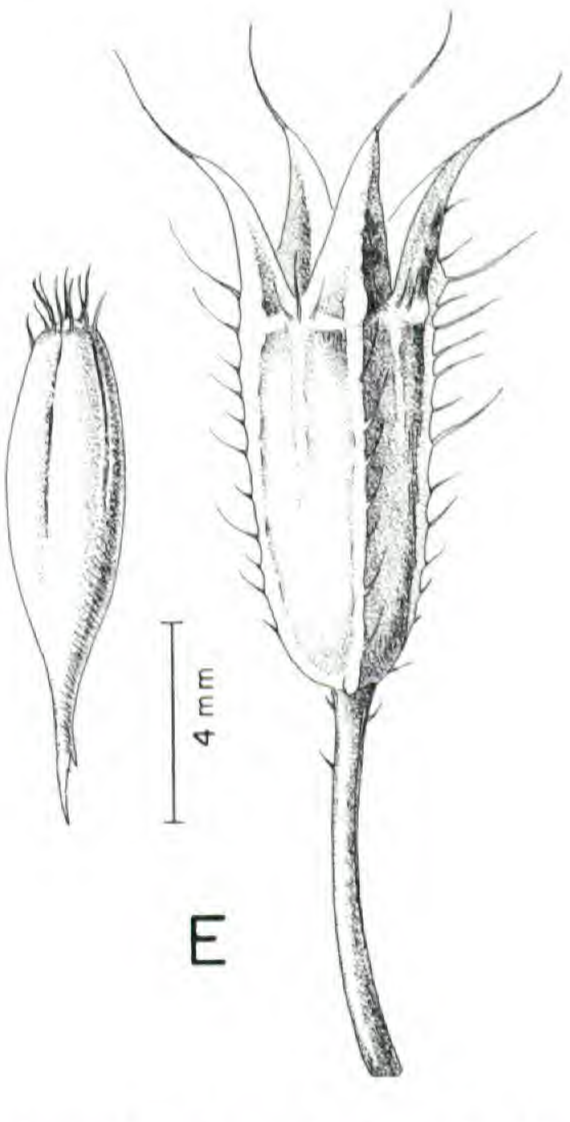


Figure 2. *Pilocosta nubicola* Almeda. —A. Habit. —B. Representative leaves, abaxial surface (left) and adaxial surface (right). —C. Ventral view of antepetalous stamen (left) and lateral view of antesepalous stamen (right). —D. Petal. —E. Ovary at anthesis (left) and mature hypanthium (right). —F. Capsule and enveloping quadrate hypanthium as seen from above. —G. Seeds. (A–F from the holotype; G from *Dryer 1059*, CAS.)

but fringed with coarse trichomes (0.5–1 mm long) closely appressed to blade margin, 12–26 mm long, 8–18 mm wide, ovate to elliptic-ovate, 5–7-plinerved, innermost pair of primary veins diverging from midvein 1.5–4 mm above base of blade, apex acute, base obtuse to rounded; adaxial surface moderately to densely villous; abaxial surface sparsely to moderately strigose on and between elevated primary veins. Flowers solitary, axillary, and ebracteate on sparsely pubescent pedicels 5–9(–12) mm

long. Fruiting hypanthium free from ovary but fully enveloping it, 7–8 mm long to the torus, 2.5 mm wide on each flat side, subcylindric, conspicuously quadrangular, moderately to sparsely beset with appressed, incurved or antrorsely spreading barbellate trichomes along the torus abaxially and on the four prominent angles but glabrous between them. Calyx lobes (fruiting hypanthia) lance-triangular, ciliate and tipped with an apical trichome 1.5–2.5 mm long, glabrous adaxially, sparsely beset with antrorsely spreading trichomes mostly on the midvein abaxially, 3 mm long and 2 mm wide at the base. Petals 4, pink but white basally on the adaxial surface, obovate, entire, ciliate, 12.5–15 mm long, 10–13.5 mm wide. Stamens 8, alike in form but unequal in size, thecae curved upward, yellow, linear-subulate with a ventrally inclined apical pore, channeled along the connective, which is prolonged basally and modified into a bilobate ventral appendage. Larger (antesepalous) stamens: filaments 3.5–4 mm long, anthers 4 mm long, 0.5 mm wide, connective prolongation and appendage each 0.25 mm long. Smaller (antepetalous) stamens: filaments 3–3.5 mm long, anthers 2.5 mm long, 0.5 mm wide, connective and appendage each just under 0.5 mm long. Ovary superior, 4-celled, glabrous but setose apically around the stylar scar. Style 7–8 mm long, glabrous, declinate and curved apically below the punctiform stigma but often appearing straight when dry. Capsule dry, semiwoody, loculicidal; seeds ca. 0.5 mm long, cochleate and tuberculate, dark brownish black at maturity. Chromosome number: $n = 11$.

Distribution. Known only from the Monteverde Cloud Forest Reserve on the Cordillera de Tilarán in northwestern Costa Rica where it typically grows in exposed areas bordering cloud forests or along trails with an Atlantic slope exposure at elevations of 1,200–1,580 m. This species was listed as *P. aff. erythrophylla* in the vascular plant checklist of the Monteverde Cloud Forest Reserve (Haber, 1991).

Like *Pilocosta erythrophylla*, one of the most conspicuous features of *P. nubicola* is the deep red pigmentation of hypanthia and abaxial foliar surfaces. These two species also share an herbaceous habit, stamens that are completely yellow in color, and hypanthia that are pubescent on the four angles but glabrous between them. It is the similarity in these characters that weighed heavily in the initial decision to associate *P. nubicola* with *P. erythrophylla* (Almeda & Whiffin, 1981).

The most consistent differences between *Pilocosta nubicola* and *P. erythrophylla* involve the size, venation, and pubescence of the leaves. In the former, leaf blades are 12–26 × 8–18 mm, 5–7-plinerved with the innermost pair of primary veins diverging from the midvein 1.5–4 mm above the blade base, and abaxial pubescence that is sparsely to moderately strigose on and between the elevated primary veins. In *P. erythrophylla* leaf blades are 2–13 × 1–9 mm, 3–5-nerved, or if plinerved, the innermost pair of primaries diverge from the midvein 0.5–1 mm above the blade base, and are essentially glabrous abaxially or with scattered trichomes restricted to the elevated primaries.

Aside from differences in base chromosome numbers for each species ($n = 11$ in *P. nubicola* vs. $n = 7$ in *P. erythrophylla*) other diagnostic differences between them are mostly quantitative. In *P. nubicola*, the petals are consistently larger (12.5–15 × 10–13.5 mm) and the pollen has a mean diameter of 20.3 μm (range 18.8–23.5 μm). In contrast, *P. erythrophylla* has petals that are 7–11 × 5–9 mm and a consistent mean pollen diameter of 15.9 μm for both diploid (range 15.3–16.5 μm) and tetraploid (range 14.1–16.5 μm) populations.

The only other species with which *Pilocosta nubicola* might be confused is *P. nana*. These species are similar in habit, leaf size, and coloration of the anther thecae but are readily distinguished by the features described in the key.

The name for this species is derived from *nubicolus*, Latin for dwelling among the clouds, in reference to the Monteverde Cloud Forest Reserve where *P. nubicola* is apparently endemic.

Paratypes. COSTA RICA. **Alajuela–Guanacaste–Puntarenas Border:** Cordillera de Tilarán, Monteverde Cloud Forest Reserve on road beyond Sendero Pantanoso jct. enroute to Peñas Blancas Valley, 23 Feb. 1986 (fl), *Almeda et al. 5072* (CAS, CR, TEX); El Brillante, Monteverde, Cordillera de Tilarán, 14 Dec. 1976 (fl, fr), *Dryer 1059* (CAS, F). **Puntarenas:** 4 km E of Monteverde, Cordillera de Tilarán, 19 May 1977 (fl), *Lawton 1169* (F).

5. Pilocosta oerstedii (Triana) Almeda & Whiffin, Syst. Bot. 5: 305. 1980 [1981]. *Pterolepis oerstedii* Triana, Trans. Linn. Soc. London 28: 40. 1871. TYPE: Costa Rica, without further locality, *Oersted 2967* (lectotype, designated by Almeda & Whiffin (1981), BM; isolectotypes, C, CAS, F, US).

A distinctive field character of *P. oerstedii* is the striking silver silky indument on adaxial foliar surfaces.

This species is local and uncommon throughout most of its range. Available collections exhibit a patchy distribution in central Costa Rica from the San Ramon region and the Cerros de Escazú to the

northwestern sector of the Cordillera de Talamanca with disjunct populations in the western provinces of Panama (Bocas del Toro and Chiriquí) at 900–2,000 m. The few recent collections of *P. oerstedii* were made in the Cerro Colorado region of western Panama, the only area to my knowledge where the species is represented by more than just a few individuals.

Pilocosta oerstedii is fairly uniform morphologically but puzzling in having haploid chromosome numbers of $n = 11$ (Panama) and $n = 18$ (Costa Rica). Additional sampling is needed to determine whether there is a consistent geographic pattern to these disparate chromosome numbers.

Solt & Wurdack (1980) reported a chromosome count of $2n = 66$ for this species [as *Tibouchina oerstedii* (Triana) Cogniaux]. Examination of the voucher (*Schnell 1027*, US) reveals that it is in fact *P. nana*, the only species in the genus with hexaploid populations.

Acknowledgments. I thank Ellen del Valle for preparing the line drawings in Figure 2,; Pablo Sánchez Vindas, Gina Umaña Dodero, and Manuel Ramirez for logistical help in Costa Rica; Barry Anderson, Thomas F. Daniel, and Nathan Jay Friedman for field assistance; Tsan Iang and Fei-Mei Chuang for help with the cytological work; the Tropical Science Center in Costa Rica for granting permission to collect specimens in the Monteverde Cloud Forest Reserve; and the curators and staffs of herbaria cited for the opportunity to examine material under their care.

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Dilleniaceae Novae Neotropicarum. II. Tres Nuevas Especies y Dos Nuevas Subespecies del Género *Doliocarpus* (Dilleniaceae)

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RESUMEN. El estudio de las colecciones neotropicales de la familia Dilleniaceae en el Herbario del Jardín Botánico de Missouri, ha dado como resultado el hallazgo de tres nuevas especies del género *Doliocarpus* (*D. chocoensis*, *D. dressleri*, y *D. pipolyi*) y dos nuevas subespecies (*D. dasyanthus* subsp. *robustus* y *D. spatulifolius* subsp. *tuberculatus*), las cuales se describen en el presente artículo. También se incluyen discusiones sobre su morfología y sus relaciones con especies afines.

ABSTRACT. Three new species, *Doliocarpus chocoensis*, *D. dressleri*, *D. pipolyi*, and two new subspecies, *Doliocarpus dasyanthus* subsp. *robustus* and *D. spatulifolius* subsp. *tuberculatus* are described and illustrated, and their phylogenetic relationships are discussed.

Doliocarpus chocoensis Aymard, sp. nov. TIPO: Colombia. Depto. Chocó: road to Lloró 2 km S of Yuto, 100 m, 5°39′N, 76°37′W, pluvial forest, lateritic soil, 13 junio 1982, *A. Gentry y J. Brand M. 36830* (holótipo, MO; isótipo, COL).

Species haec *D. sessilifloro* Martius affinis, sed foliis chartaceis, oblanceolatis, basi attenuata, margine haud revoluta, ciliata, supra costa nervisque canaliculatis, subtus haud verruculosis, sepala 4, extus laxe adpresso-pubescentibus, 4–6 mm longis, differt.

Liana; ramas grisáceo-rojizas, laxamente pilosas en la madurez. Hojas cartáceas, oblanceoladas, 5–11 cm de largo, 2–4 cm de ancho, base atenuada, ápice apículado-cuspidado, márgenes no revolutos, ciliados, dentados a partir de ⅓ de la base, esparcido-pilosos por la haz, más evidente en el nervio medio, el cual es canaliculado, amarillo adpreso pubescente por el envés, más evidente en el nervio medio y nervios laterales; pecíolo 4–7 mm de largo, adpreso pubescente. Inflorescencias glomérulos sesiles, flores no vistas; pedúnculos 0.5–1 mm de largo; brácteas presentes, situadas en la base del pecíolo, adpreso-tomentosas; sépalos en el fruto 4, oblongos, 4–6 mm de largo, laxamente adpresos pubescentes externamente, glabros internamente; pétalos no vistos, frutos 4–6 mm de diámetro; pubescencia esparcida, adpresa de color blanco, estilo y estigma glabros.

Distribución geográfica. Sólo se conoce en selvas pluviales macrotérmicas sobre suelos lateríticos del Departamento del Chocó, Colombia.

Doliocarpus chocoensis pertenece a la sección *Calinea* (Kubitzki, 1971) y junto con *D. prancei* Kubitzki, *D. macrocarpus* Martius, y *D. sessiliflorus* Martius se agrupan en las especies del género con ovario pubescente e inflorescencias sesiles. Esta nueva especie muestra afinidad con *D. sessiliflorus*, pero se diferencia de esta por los caracteres mencionados en la siguiente clave:

1a. Hojas cartáceas, oblanceoladas, base atenuada, márgenes no revolutos, ciliados, nervio medio caniculado por la haz, envés no verruculado; sépalos 4, pubescencia laxa y adpresa externamente, no sericea, 4–6 mm de largo en el fruto ..... *D. chocoensis*

1b. Hojas coriáceas, lanceoladas u obovadas, base cuneada, márgenes revolutos, no ciliados, nervio medio impreso por la haz, envés muy verruculado; sépalos 5–6, externamente densamente seríceos, 8 mm de largo en el fruto .. .. *D. sessiliflorus*

Doliocarpus dressleri Aymard, sp. nov. TIPO: Panamá. Prov. Panamá: La Eneida, Región del Cerro Jefe, 30 mar. 1968, *R. L. Dressler 3468* (holótipo, MO).

Species haec *D. areolato* Kubitzki affinis, sed ramulis glabris, foliis chartaceis vel subcoriaceis, oblongo-obovatis, subtus venatione tertiaria transverse reticulata atque discrete areolata, pedunculis 4–5 longis, sepalis ovato-elipticis, intus sericeis, 5–8 mm longis, differt.

Liana leñosa; ramas grisáceas, glabras. Hojas cartáceas a subcoriáceas, oblongo-obovadas, 22 cm de largo, 13 cm de ancho, base redondeada, ápice obtuso, márgenes subcrenados, glabros por la haz, pilosos por el envés, principalmente en el nervio principal y nervios secundarios, venación terciaria reticulada, discretamente areolada; pecíolo canaliculado, muy robusto en la base, basalmente adpreso-pubescente, 2.8 cm de largo. Inflorescencia glomerulada, pedúnculos no ramificados, densamente

adpreso-pubescentes, 4–5 mm de largo; sépalos 5, obovado-elípticos, 5–8 mm de largo, 4–6 mm de ancho, seríceos externamente, laxamente seríceos internamente, principalmente en la parte media; pétalos no vistos; estambres 50–60, filamentos glabros o pubérulados, anteras 0.5 mm de largo; ovario densamente híspido. Frutos globosos adpreso-pubescentes, 9 mm de diámetro.

Distribución Geográfica. Doliocarpus dressleri sólo se conoce de la colección del tipo; en bosques muy húmedos de la región del Cerro Jefe en Panamá. La familia ya fue tratada para este país (Hunter, 1965), pero exploraciones posteriores han puesto en evidencia que las Dilleniaceae que ocurren en Panamá son más numerosas y representan un grupo fitogeograficamente muy interesante.

Doliocarpus dressleri pertenece a la sección *Doliocarpus* (Kubitzki, 1971) y está relacionada con *D. areolatus* Kubitzki (Kubitzki, 1973), pero se diferencia de esta especie por los caracteres mencionados en la siguiente clave:

1a. Hojas cartáceas a subcoriáceas, ovadas, oblongo-ovadas, venación terciaria discretamente areolada; pedúnculos 4–5 mm de largo; sépalos ovado-elípticos, seríceos internamente, 5–8 mm de largo ..... *D. dressleri*
1b. Hojas rígido-coriáceas, lanceoladas, obovado-lanceoladas, venación terciaria fuertemente reticulada, formando aréolas muy evidentes; pedúnculos 1–2 mm largo; sépalos elípticos, 4–5 mm de largo, glabros internamente . *D. areolatus*

Por otra parte, *Doliocarpus arealatus* Kubitzki, hasta el presente sólo se conoce en sabanas arbustivas macrotérmicas de tipo amazónico y en bosques ribereños (igapó) sobre suelos arenosos, (Quartzipsament) mal drenados, oligotróficos y extremadamente ácidos de la Amazonía venezolana y brasilera.

Doliocarpus pipolyi Aymard, sp. nov. TIPO: Perú. Loreto: Prov. Maynas, Dtto. Las Amazonas, cerca de la quebrada "Sucusari," Río Napo, 3°20′S, 72°25′W, 100–140 m, bosques primarios de terra firme, 23 feb. 1991, *J. Pipoly et al. 13420* (holótipo, MO; isótipos, AMAZ, PORT, USM). Figura 1.

Species haec *Doliocarpus hispido* Standley & L. Williams affinis sed foliis obovato-oblanceolatis, basi attenuati, apice rotundato haud apiculati, margine ciliati, nervis laxe adpresso-pubescentibus, 6–13 cm longis, petiolis 4–7 mm longis, adpresso-pubescentibus, pedunculis sericeo-pubescentibus, sepalis externe sparse adpresso-pubescentibus, baccis sparce adpresso-pubescentibus, albis, differt.

Liana leñosa; ramas y ramitas marrones, laxamente adpreso-pubescentes, estriadas. Hojas cartáceas, obovadas, oblanceoladas, 6–13 cm de largo, 2–6 cm de ancho, base atenuada, ápice obtuso, margenes dentados, ciliados, esparcido-pilosas y laxamente adpreso-pubescentes en el nervio medio por ambas caras; pecíolos 4–8 cm de largo, adpreso pubescentes. Inflorescencias fasciculadas, pedúnculos no ramificados, densamente seríceos pubescentes, 5–11 mm de largo, brácteas en la base de los pedúnculos ovadas, 2–3 mm de largo, densamente seríceas externamente, esparcido-adpreso-pubescentes internamente. Sépalos en los frutos 4–5, ovado-elípticos, 4–6 mm de largo, externamente esparcido-adpreso-pubescentes, glabros internamente, pétalos no vistos. Frutos 6–8 mm de diámetro, pubescencia blanca, esparcida y adpresa; semilla una.

Distribución geográfica. Bosques muy húmedos macrotérmicos no inundables en la amazonía Peruana.

Doliocarpus pipolyi pertenece a la sección *Calinea* (Kubitzki, 1971) y está relacionada con *D. hispidus* Standley & L. Williams; se diferencia de esta especie por los caracteres mencionadas en la siguiente clave:

1a. Hojas 6–13 cm de largo, obovadas, oblanceoladas, base atenuada, ápice redondeado, márgenes ciliados; laxamente adpreso-pubescentes en el nervio medio; pecíolos 4–7 mm de largo, laxamente adpreso-pubescente por el envés; pedúnculos seríceos; sépalos externamente y frutos con pubescencia esparcida, adpresa de color blanco ..... *D. pipolyi*
1b. Hojas 10–21 cm de largo, elípticas, elíptico-obovadas, base cuneada, ápice apiculado-acuminado, márgenes no ciliados; híspido-pubescentes en el nervio medio; pecíolos 1.5 cm de largo, híspido-pubescentes; pedúnculos híspido-pubescentes; sépalos externamente y frutos con pubescencia densamente híspido-pilosa de color amarillo ocre ..... *D. hispidus*

También *Doliocarpus pipolyi* muestra similitud con *D. hispidobaccatus* Aymard (Aymard, 1991), pero se diferencia de esta especie por poseer las hojas cartáceas, obovado-oblanceoladas y los frutos 6–8 mm de diámetro, con pubescencia esparcida, adpresa, de color blanco. *Doliocarpus hispidobaccatus*, en cambio, posee hojas subcoriáceas a coriáceas, obovado-elípticas, y los frutos 1.2–2 cm de diámetro, densamente pubescentes, con dos clases de tricomas: cortos (0.2–0.5 mm) y largos (1–2 mm) de color amarillo.

Doliocarpus dasyanthus Kubitzki subsp. **robustus** Aymard, subsp. nov. TIPO: Panamá. Prov. Panamá: along El Llano to Carti road, 9°15′N, 79°00′W, 150–250 m, 15 dic. 1987, *G. McPherson 11862* (holótipo, MO unicata).

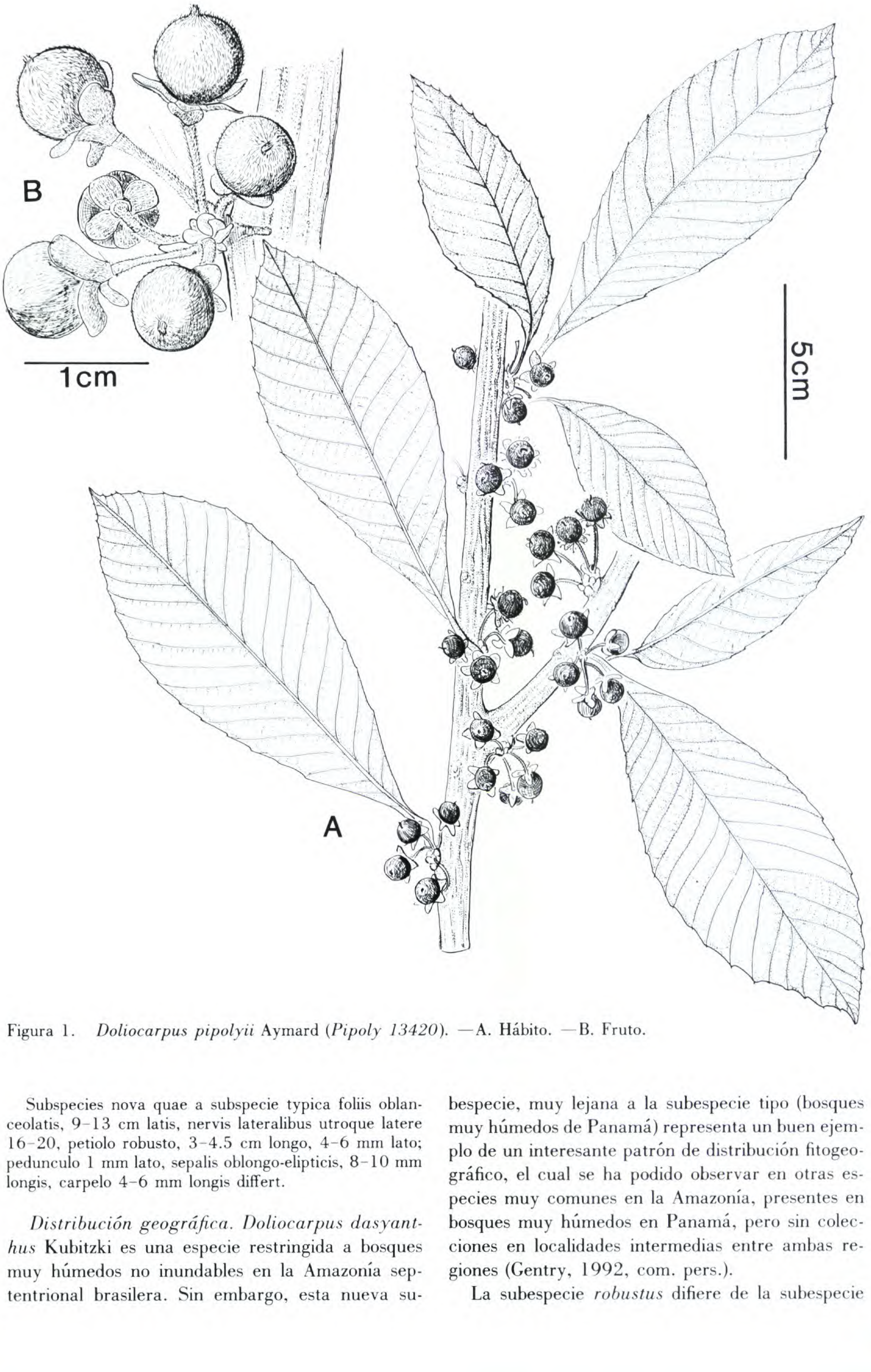

Figura 1. *Doliocarpus pipolyii* Aymard (*Pipoly 13420*). —A. Hábito. —B. Fruto.

Subspecies nova quae a subspecie typica foliis oblanceolatis, 9–13 cm latis, nervis lateralibus utroque latere 16–20, petiolo robusto, 3–4.5 cm longo, 4–6 mm lato; pedunculo 1 mm lato, sepalis oblongo-elipticis, 8–10 mm longis, carpelo 4–6 mm longis differt.

Distribución geográfica. Doliocarpus dasyanthus Kubitzki es una especie restringida a bosques muy húmedos no inundables en la Amazonía septentrional brasilera. Sin embargo, esta nueva subespecie, muy lejana a la subespecie tipo (bosques muy húmedos de Panamá) representa un buen ejemplo de un interesante patrón de distribución fitogeográfico, el cual se ha podido observar en otras especies muy comunes en la Amazonía, presentes en bosques muy húmedos en Panamá, pero sin colecciones en localidades intermedias entre ambas regiones (Gentry, 1992, com. pers.).

La subespecie *robustus* difiere de la subespecie

típica, por los caracteres que se mencionan en la siguiente clave:

1a. Hojas oblanceoladas, 9–13 cm de ancho, nervios laterales 16–20; pecíolos muy robustos, 3–4.5 cm de largo, 4–6 mm de ancho; pedúnculos 1 mm de ancho; sépalos oblongo-elípticos, 8–10 mm de de largo, ovario 4–6 mm de largo ..... *D. dasyanthus* subsp. *robustus*

1b. Hojas obovado-oblongas, 3–8 cm de ancho, nervios laterales 11–14; pecíolos 1–2 cm de largo, 1–2.5 mm de ancho; pedúnculos 0.5 mm de ancho; sépalos elípticos, 4–6 mm de de largo y ovario 2–4 mm de largo ..... *D. dasyanthus* subsp. *dasyanthus*

Doliocarpus spatulifolius Kubitzki subsp. **tuberculatus** Aymard, subsp. nov. TIPO: Bolivia. Santa Cruz: Perseverancia, NW of Santa Cruz, Río Negro, 14°38′S, 62°37′W, 100 m, 13 mayo 1991, *A. H. Gentry et al. 73799* (holótipo, MO; isótipo, PORT).

Subspecies nova quae a subspecie typica foliis subcoriaceis, subtus glabris vel vix pilosis, tuberculatis, petiolo glabro differt.

Distribución geográfica. Esta nueva subespecie sólo se conoce de la localidad del tipo, en bosques húmedos macrotérmicos en Santa Cruz, Bolivia.

La subespecie *tuberculatus* difiere de la subespecie tipíca por poseer las hojas subcoriáceas, envés muy tuberculado, glabro o laxamente piloso, y los pecíolos glabros en lugar de hojas coriáceas, envés sin tubérculos, tomentoso y los pecíolos adpresos pubescentes.

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On *Aristolochia thwaitesii* Hooker (Aristolochiaceae)

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ABSTRACT. The Central American plants previously known as *Aristolochia thwaitesii* Hooker are described as new and given the name *Aristolochia stevensii* Barringer. The name *A. thwaitesii* is correctly used for a Chinese species.

Two different species have come to be called *Aristolochia thwaitesii* Hooker. One is native to Central America (Pfeifer, 1966) and one is native to China (Hwang, 1988; Ma, 1989). W. D. K. Thwaites was an energetic collector and director of the Botanical Garden at Perideniya, Ceylon [Sri Lanka]. He collected in Ceylon and Great Britain, so how a Central American and a Chinese species came to be named for him is a puzzle.

William Hooker (1856) illustrated and described *Aristolochia thwaitesii* from a cultivated specimen growing at Kew. The plant was an unusual suffruticose herb with narrowly ovate leaves and basal, branching inflorescences. The flowers had curved calyces and a three-lobed gynostemium. He believed that the original seed was received from Ceylon and named the species in honor of Thwaites. Later, in a note after a plate of the Central American species *A. arborea* Linden, Hooker (1862) noted that *A. thwaitesii* was not from Ceylon and guessed that it might be similar to a species collected by Purdie in Santa Marta, Colombia.

Following up on this reference, Pfeifer searched the New World material for a plant resembling the original description and illustration. In Central America, the shrubby, cauliflorous species with three-lobed gynostemia form a distinctive group that includes *Aristolochia arborea* and *A. panamensis* Standley. Pfeifer (1966) discovered specimens that appeared to match the original description and assigned them to *A. thwaitesii*. He did not realize that the true *A. thwaitesii* had been located elsewhere.

Ten years after his father's note, J. D. Hooker (1871) had published a further note after a plate of *Dorstenia mannii* Hooker f. that went unnoticed by Pfeifer. Hooker wrote that *Aristolochia thwaitesii* was not from either Ceylon or Colombia but from the Old Calabar River region of east Africa, what is now southern Nigeria. He had received a note from Mr. Bullen, a curator at Glasgow, that a specimen matching the description had been sent by Mr. Thompson from that area. This, too, would prove to be mistaken.

Later, Tuchter (1905) collected a plant that matched Hooker's original description and plate. He found it growing under bamboo near Wong Ne Chong and at the base of Black Mountain on Hong Kong. These plants are the true *Aristolochia thwaitesii* and have been described as such by Tuchter (1905), Dunn & Tuchter (1912), Hwang (1988), and Ma (1989). They match the protologue and the lectotype, *Westland s.n.* (K).

The Purdie collection W. J. Hooker saw and confused with *Aristolochia thwaitesii* is probably *A. maxima* Jacquin. That species is a woody liana with 6-lobed gynostemium that often has narrowly ovate to lanceolate leaves and branched, basal inflorescences. It is common around Santa Marta (González, 1990), and a Purdie collection exists that has very long inflorescences. The African plant grown at Glasgow from Old Calabar is probably *A.* (*Paraaristolochia*) *juju* S. Moore, a liana with a triangulate calyx limb and cauliflorous, racemose inflorescences. A collection by Mann from Old Calabar exists. The Central American species, called *A. thwaitesii* by Pfeifer (1966), is a distinct species now in need of a name.

Aristolochia stevensii Barringer, sp. nov. TYPE: Nicaragua. Matagalpa: along Hwy. 3, 6.6 km N of Matagalpa (El Tuma intersection), ca. km 137.5, 12°59′N, 85°55′W, 1,200–1,250 m, 24 May 1981, *Stevens & Henrich 20353* (holotype, BKL; isotypes, F, MO). Figure 1.

Species *A. rhizanthae* Lundell affinis sed liana foliis ovatis cordatis seu auriculatis subtis tomentosis utriculis truncatis differt; ab *A. thwaitesii* Hooker limbo calycis manifeste tridentato gynostemii columna differt.

Liana. Stems woody, to 2 cm diam., the young stems tomentose, the older stems with slightly winged, corky bark. Pseudostipules absent. Leaves alternate; petioles 10–15 mm long, 2–3 mm diam., tomentose; blades ovate, 9–17 cm long, 4–9 cm wide, subcoriaceous, glabrous above, tomentose below, the base cordate-auriculate, the lobes 10–12 cm long, often

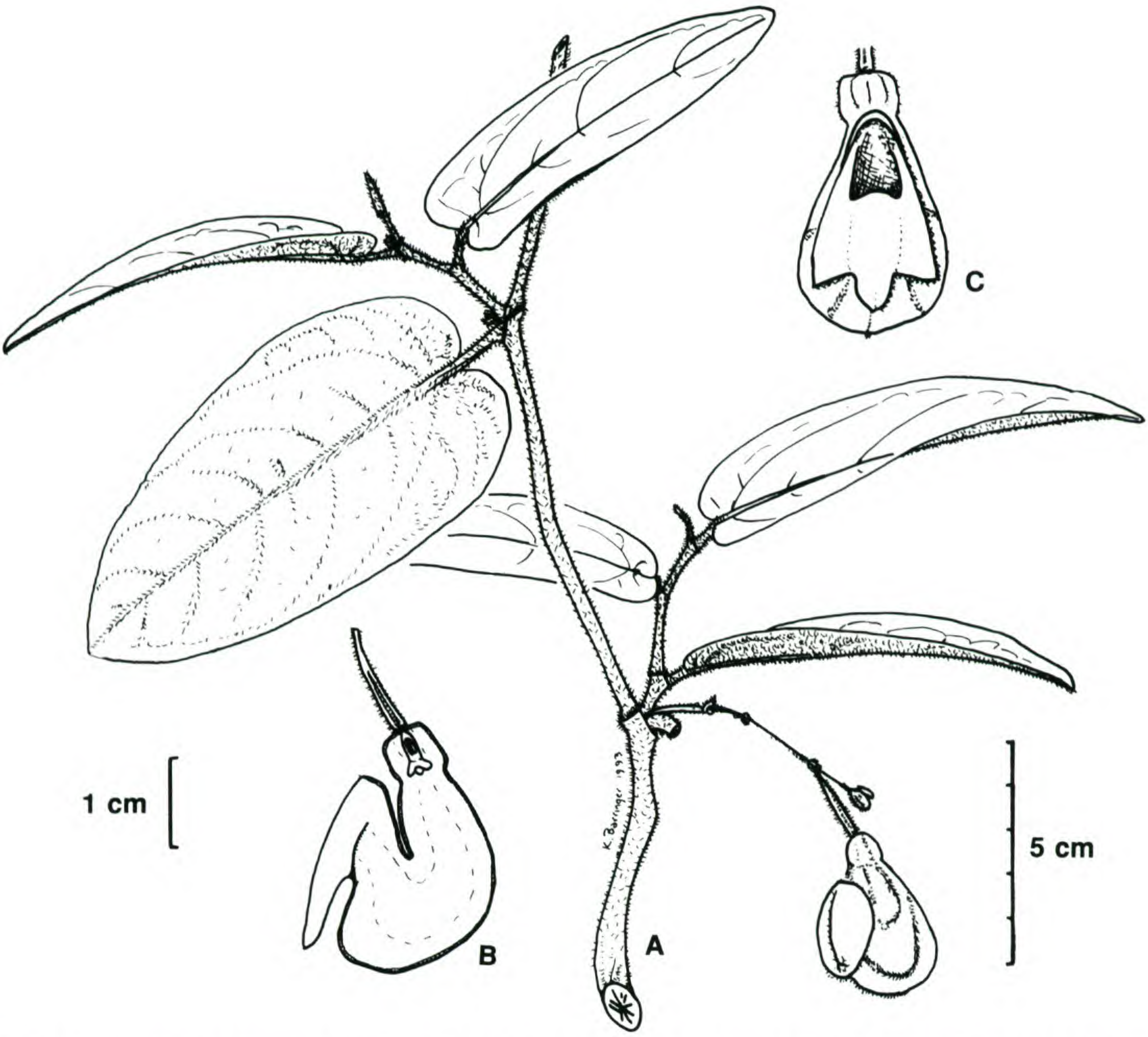

Figure 1. *Aristolochia stevensii* Barringer. —A. Habit with bud and leaf turned to show tomentose underside (*Peña 122*, MO). —B. Longitudinal section of flower (*Stevens & Henrich 20353*, BKL). —C. Front view of flower (*Stevens & Henrich 20353*, BKL).

overlapping, the apex obtuse to rounded, often minutely apiculate. Inflorescences racemose, axillary, bracteate, usually borne on older stems, but also borne on younger growth; calyx to 4 cm long, bent, dull yellow to yellow-brown, the utricle inflated, 7–10 mm long, 5–7 mm wide, truncate at base, usually with a slight constriction where it joins the tube, but the tube and utricle can be difficult to distinguish, the tube strongly bent, greatly inflated along the lower side, 2–2.5 cm wide, the limb unequally 3-lobed, brown, glossy within, the lateral lobes triangulate, 5 mm long, 17–20 mm wide at base, the midlobe lowermost, ovate, 5–7 mm long, the throat dark purple above, white to pale yellow below; gynostemium 3-lobed, columnar, 5–10 mm tall, stalked, the anther 6, in three groups. Capsules not seen.

This species is named for Warren Douglas Stevens, whose collections have added greatly to our understanding of the flora of Nicaragua. It grows in wet forest around 1,000 m in the mountains of southwestern Honduras and northwestern Nicaragua. It is usually found in secondary growth at the edge of forests.

Paratypes. HONDURAS. **Francisco Morazán:** Cerro Triquilapa (La Montañita), 15 km carretera a Danalí, Tegucigalpa, 25 Julio 1975, *C. Nelson 2781* (MO, UNAH); Cerro Triquilapa, 1,780 m, 14 km E de Tegucigalpa, 25 July 1975, *M. E. Peña 122* (MO); Tegucigalpa, *Standley 9734* (F). NICARAGUA. **Jinotega:** *Molina R. 10691* (F). **Matagalpa:** km 135 carretera a Jinotega, Molino Norte, 12°58′N, 85°55′W, 1,000–1,100 m, 25 June 1981, *P. Moreno 9498* (BKL, MO).

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Nomenclature of *Sessea corymbiflora* (Solanaceae) and its Occurrence in Venezuela

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ABSTRACT. The occurrence of *Sessea corymbiflora* in Venezuela is reported for the first time. It is presented here as a new species and an additional genus for the solanaceous flora of Venezuela. A description and illustration of the species are provided. The contorted nomenclature of *S. corymbiflora* is discussed, and the names *S. corymbosa* and *S. atrovirens*, in current use as referring to distinct entities, are reduced to synonymy.

Sessea, a poorly known genus mainly of Andean regions of South America, was hitherto unknown in Venezuela. The plants and their flowers closely resemble those of the much larger genus *Cestrum*, but the fruits and seeds are quite distinctive. The species reported here was discovered among specimens of *Cestrum* while the authors worked on a taxonomic revision of this genus.

Sessea was first described by Ruiz & Pavón in their series of works on the flora of Peru and Chile. The genus was described and illustrated in the *Prodromus* (1794), two species were described in the *Systema Vegetabilium* (1798), and these were illustrated in the *Flora Peruvianae et Chilensis* (1799). The species reported here, *S. corymbiflora* Taylor & Phillips, was described two decades later from material collected in Colombia. The larger genus *Cestrum*, which is similar to *Sessea*, was described by Linnaeus in 1753.

Besides the original descriptions noted and other minor comments, the genus has had overall consideration by only three botanists, Bitter (1922), Francey (1933, 1934, 1935: 46–51), and Toledo (1941). Bitter arranged species into five series, and Francey and Toledo provided keys to the species published up to the time of their works. Diversity is apparently greatest in Peru, Ecuador, and Colombia, although two species occur in Brazil, one is recorded from Haiti, and we report one from Venezuela.

THE GENUS *SESSEA*

Sessea Ruiz & Pavón, Fl. Peruv. 21. 1794. TYPE: *S. stipulata* Ruiz & Pavón, (lectotype, designated by D'Arcy, Solanac. Newsl. 2(4): 30. 1986).

Sesseopsis Hassler, Ann. Cons. Jard. Bot. Genève. 20: 183. 1916. TYPE: *S. vischeri* (Chodat) Hassler = *Sessea vischeri* Chodat cf. Hunziker (1977).

In traditional classifications (D'Arcy, 1991), *Sessea* is placed in the Solanaceae in tribe Cestreae of subfamily Cestroideae. This tribe comprises five genera. Three of these are monotypic with widely separated distributions (D'Arcy, 1992): *Metternichia*—Rio de Janeiro, Brazil; *Tsoala*—western Madagascar; and *Vestia*—south-central Chile. Each of these has corollas and fruit quite different from *Sessea*, although *Vestia* is most similar in overall appearance. The remaining two genera are *Sessea* and *Cestrum*. *Cestrum* includes over 150 species distributed throughout warm regions of the Americas, and it is the only genus in the tribe with a juicy, berry fruit that is dispersed by birds. All members of tribe Cestreae except *Cestrum* have a dry capsule. In *Tsoala*, dehiscence of the capsule is unknown, but in *Sessea*, *Vestia*, and *Metternichia*, the capsule is longitudinally dehiscent.

Sessea corymbiflora Goudot ex Taylor & Phillips, Phil. Mag. 3: 132. 1828. TYPE: in woods near Bogotá, *Goudot 1* (lectotype, P; isolectotypes, K not seen, G-DC not seen, microfiche MO, G). Figure 1.

Sessea corymbosa Miers, Hook. London J. Bot. 5: 156. 1846. Syn. nov. TYPE: Bogotá ad Barro Blanco, *Goudot 1* (holotype, K not seen; isotypes, G-DC not seen, microfiche MO, P, G).

Cestrum atrovirens Dunal in DC., Prodr. 13(1b): 648. 1852. Syn. nov. *Sessea atrovirens* (Dunal) B. D.

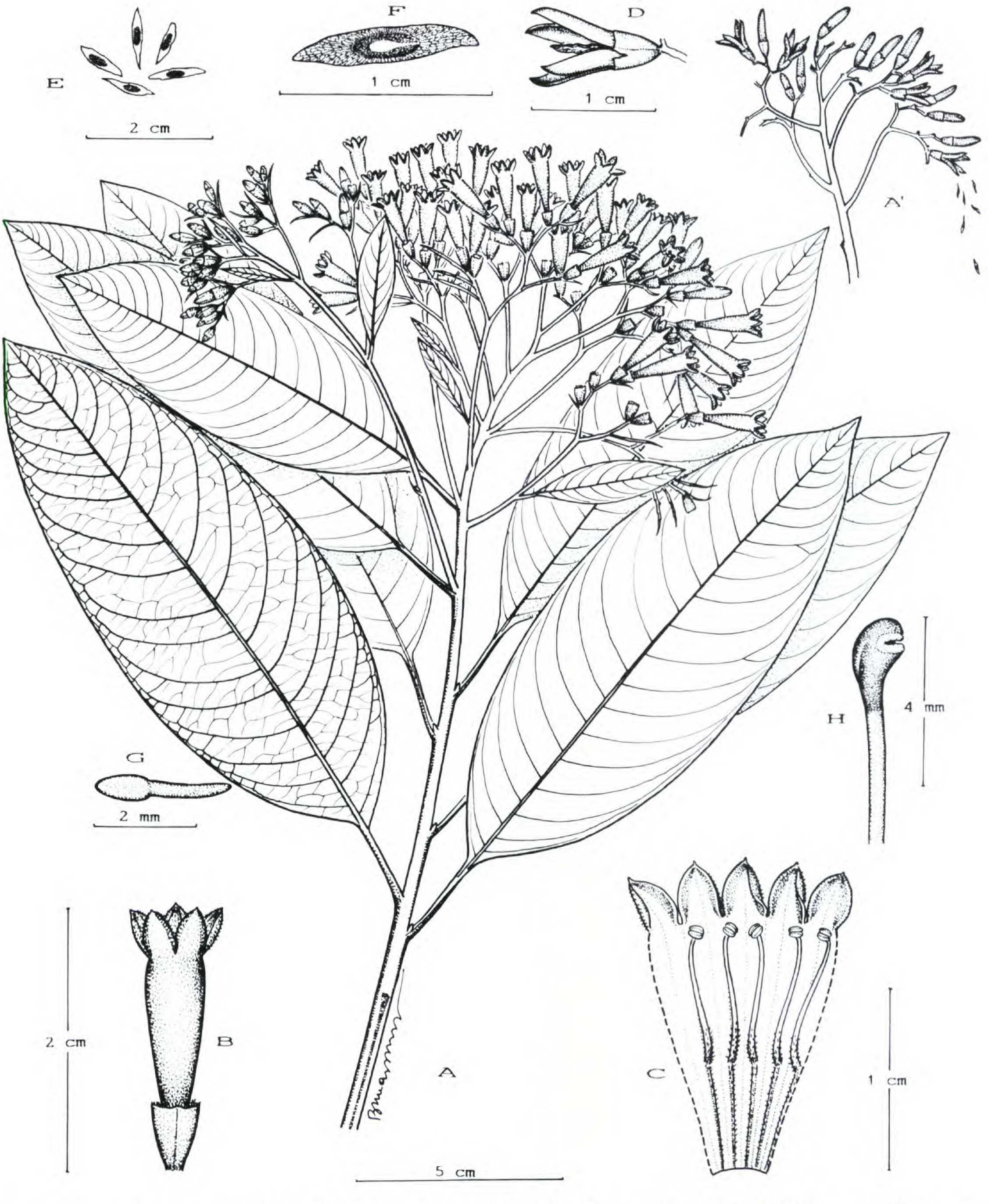

Figure 1. *Sessea corymbiflora* Goudot ex Taylor & Phillips (*Ruiz Teran 7552*, MERF). —A. Habit with inflorescence. —A'. Infructescence. —B. Flower, lateral view. —C. Opened flower. —D. Opened capsule. —E. Seeds. —F. Seed showing body and wing. —G. Embryo. —H. Stigma.

Jackson, Ind. Kew. 2: 892. 1895. Redundant combination in Bitter, Feddes Repert. 18. 223. 1922. TYPE: Peru. Quito: *Hartweg 1309* (holotype, G; isotypes, B, K, neither seen, P).

Shrubs or *trees* to 16 m tall; unarmed, pubescence of reduced moniliform simple hairs to 0.5 mm long, glabrous on most parts; twigs angled from the petiole bases and often striate-furrowed. *Leaves* 11–15 per twig, not odorous, perennial, elliptical, occasionally ovate or obovate, mostly 9–13(–20) × 3–5(–6) cm, apically obtuse or acute, sometimes slightly short-acuminate, basally obtuse, margins

sometimes slightly revolute, glabrous or with occasional reduced trichomes near the base, coriaceous or firmly membranous, costa drying dark above, elevated and excurrent beneath, major veins 17–20, mostly evenly spaced 3–6 mm apart, arcuate at 30–40° to the costa, plane above, finely reticulate beneath, drying reddish or slate-gray; minor leaves mostly wanting, when present oblong, to 6 cm long and resembling the major leaves; petioles mostly slender, 5–25 mm long, slightly scurfy with reduced trichomes, drying darker than the leaf, especially at the base. *Inflorescences* lax, crowded, terminal corymbs to 6 cm long; peduncles and pedicels drying dark, pedicels wanting, bracts few, scattered among the inflorescence and resembling reduced leaves; pedicels obsolete; bracteoles 1.5 mm long, narrowly ovate or linear, glabrate with sparse, reduced, glandular-appearing trichomes, soon caducous. *Flowers* numerous (83), crowded, malodorous, 12–20 mm long; calyx dark green, tubular-obconical, 5–6 × 4 mm, outside glabrous, the costas sometimes conspicuous, the lobes sinuate-deltoid, 0.5 mm long, minutely ciliate, but not tufted apically, pubescent within; corolla green with purple areas, exserted 9–13 mm from the calyx, tube 13–18 mm long, basally slender, 1 mm wide, expanding about ⅓-way up to 4–5 mm wide, glabrous outside, the fine nerves inconspicuous, glabrous within, the lobes 1–3 mm long, obtuse or rounded, glabrous outside; stamen insertion levels subequal, filaments adnate 6–7 mm, 6 mm free, the free insertion 1.5–2 mm, distal free portion 5 mm long, insertion tumid, a few minute hairs present just below the insertion, distal portion glabrous; style 12–13 mm, glabrous, stigma unequally bilobate, the two lobes forming a mouth flanking the stigmatic surface; ovary glabrous, subsessile, ovules 6–8. *Fruit* a woody, apically dehiscent capsule, 6–7 mm long, the valves 4, linear, 2.5 mm wide at the base; fruiting calyx slightly accrescent, 6–7 mm, enclosing the base of the capsule, splitting irregularly; seeds 5–12, appearing flat and 14–15 mm long overall, the seed itself ellipsoidal, 3–4 × 1 mm, chestnut brown, surrounded by a light green, membranous, minutely reticulate, oblong wing extending 3–4 mm beyond each end of the seed and 0.25 mm on each side, the ends pointed or rounded, sometimes with one or more narrow wings in another plane; embryo white, 2.5–3 mm long, the hypocotyl straight, terete, the epicotyl laminar, broadly elliptical, forming ¼ the length of the embryo.

This species is distinct from most other members of the genus in being almost glabrous throughout. Pubescence is only found sparingly near leaf bases, on calyx and corolla lobes, and on emerging buds. The Venezuelan collections examined are quite like those from the other countries where the species occurs, Colombia and Ecuador.

This species is found in dense forests at upper elevations (2,200–2,900 m in Venezuela–Colombia, to 3,500 m in Ecuador) on rocky soils in subparamo areas. In Venezuela it is restricted to the western Andean region. In Ecuador it has been collected in both the area of the volcanos and in the area south of them, two regions that support generally different floras. In Colombia it is recorded from southern parts of the eastern and central cordilleras.

The name of this species has been the subject of considerable confusion. It was first noted in print when Taylor & Phillips, before the Linnean Society of London on 15 January 1827, read "Descriptions of three new species of plants, natives of New Granada, by M. Gondot [sic], Professor of Botany at Bogotá." One of these was "*Sessea corymbiflora, foliis obovatis attenuatisque, floribus corymbosis*—In woods near Bogotá." However, when Goudot distributed his specimens to institutions in Paris, London, Geneva, and perhaps other places, he labeled them *S. corymbosa*, and the locality on the lectotype sheet says, "Bogotá, Barro Blanco in el Boquerón." Later, when Miers, Dunal, and others referred to the species, they called it *S. corymbosa*, perhaps not knowing of its earlier description as *S. corymbiflora*.

Shortly after Goudot's record Theodor Hartweg collected a plant near Popoyán, some 375 km from Bogotá, that was also sent to various European institutions. This specimen, *Hartweg 1309*, was first recognized as new by Bentham in his *Plantae Hartwegianae* of 1846 (p. 239, date from McVaugh, 1970), but was not named then. In 1852, Dunal (p. 597) described it as *Cestrum atrovirens*, but he attributed the specimen to Quito (Peru then, Ecuador now). In 1857, in the same *Plantae Hartwegianae* series (p. 358), Bentham identified the Hartweg collection as *S. corymbosa*, but later (Bentham & Hooker, 1876: 904) he noted that *Cestrum atrovirens* was a species of *Sessea*. Much later, Bitter reported on the species, separating *S. corymbosa* from *S. atrovirens* because he had not seen the Goudot material from which *S. corymbosa* was described. More recently, Francey (1934: 989) and Toledo (1941) followed Bitter in recognizing two species.

We have examined both the Goudot and Hartweg specimens and conclude that they are the same species with little variation between them.

Material examined. COLOMBIA. *Hartweg s.n.*, sine loc. (fl) 1309 (P, G-photo, B-photo) (type of *S. atrovirens*). **Valle:** Mpio. Tulúa, Corr. Santa Lucía, Hda. La Cascada, Cerros del Japón, 2,900 m, (fl) *Devia & Prado 1999* (MO); Mpio. Tulúa, Corr. Santa Lucía, finca San Luis, bosque en bocatoma del acueducto, 2,800 m, (fr) *Devia 732* (MO). **Cundinamarca:** Bogotá, Barro Blanco en el Boquerón, 2,700–2,900 m, (fl, fr) *Goudot 1* (P, G, G-DC, not seen, microfiche MO); Bogotá, 2,700 m, (fl) *Triana 2316* (P-2 sheets). ECUADOR. **Loja:** 10 km SW of Loja along road past University toward La Violeta, 2,950 m, (fr) *van der Werff & Palacios 9076* (MO). **Carchi:** Cantón Montufar, Loma El Corazón (Bretaña), al sureste de Huaca, al este de la Colonia Huaquena, Río Minas, 3,200–3,500 m, (fl) *Tipaz 43* (MO). **Imbabura:** Cantón Otovalo, Parroquia San Luis de Quichinche, sitio San Alberto, 2,850 m, (fr) *Moran et al. 40* (MO); Cantón Otovalo, Parroquia San Luis de Quichinche, sitio San Alberto, 2,700–2,900 m, (fl) *Moran et al. 59* (MO). VENEZUELA. **Mérida:** Páramo Las Nieves 48 km S de Estanquez, Dist. Sucre, 2,500 m, (fl, fr) *Benítez et al. 4839* (MO, MY + duplicates). **Táchira:** Bosque sempreverde denso, Parque Nacional Los Páramos, quebrada Los Pos, carretera Pregonero–El Portachuelo, Dist. Uribante, 2,300 m, (fr) *Benítez & Rojas 4741* (F, MER, MERF, MO, MY, PORT, US, VEN); on steep slopes in woods, NW of Queniquea toward alcabala El Zumbador, Dist. Jaúregui, 2,400 m, (fr) *D'Arcy & Benítez 18266* (MO, MY + duplicates); 1 km SE de la alcabala Páramo El Zumbador, 7 km del pueblo El Cobre, Mpio. Jaúregui, 2,750 m, (fl) *Pietrangeli 390* (MY). **Trujillo:** entre el Alto de Tuñame y quebrada El Pajarito, carr. Tuñame–Las Mesitas, 2,950–2,900 m, (fl) *López-Palacios 7552* (MY). **Dist. Boconó:** orillas de la quebrada El Pajarito entre Tuñame y Las Mesitas, 2,900 m, (fl) *Ruiz-Terán & López-Figueiras 2205* (MY).

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New Subtribes of the Lactuceae (Asteraceae)

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ABSTRACT. The subtribal classification of tribe Lactuceae is emended to include three new subtribes: Catananchinae (Mediterranean; *Catananche*, *Hymenonema*, *Rothmaleria*), Malacothricinae (North American; *Anisocoma*, *Atrichoseris*, *Calycoseris*, *Glyptopleura*, *Malacothrix*, *Munzothamnus*, *Pinaropappus*), and Sonchinae (almost worldwide; *Sonchus*, *Launaea*, and their immediate relatives).

In a forthcoming book on the cladistics and classification of the Asteraceae (Bremer, in press), a revised tribal and subtribal classification is presented. In the tribe Lactuceae, this necessitates description of three new subtribes. The most recent subtribal classification of the Lactuceae is by Stebbins (1953), who divided the Lactuceae into eight subtribes and a number of subgroups:

Scolyminae Lessing
Cichoriinae O. Hoffmann
  Tolpis–Arnoseris generic group
  Catananche–Hymenonema generic group
Microseridinae Stebbins
Stephanomeriinae Stebbins
  Stephanomeria generic group
  Malacothrix generic group
Dendroseridinae Bentham & Hooker f.
Scorzonerinae Dumortier
Leontodontinae O. Hoffmann (= Hypochaeridinae Lessing)
Crepidinae Dumortier
  Dubyaea–Soroseris line
  Launaea–Sonchus line
  Hieracium–Andryala line
  Prenanthes–Lactuca line
  Youngia–Ixeris line
  Crepis line

This classification was modified by Jeffrey (1966), but he did not recognize any formal subtribes. I propose to combine the *Tolpis–Arnoseris* and *Hieracium–Andryala* groups as a separate subtribe Hieraciinae (Bremer, in press). This is in agreement with Jeffrey (1966), who classified these genera together in his *Tolpis* subgroup. I will also remove Stebbins's *Prenanthes–Lactuca* line to a separate subtribe Lactucinae (Bremer, in press). Both subtribal names, Hieraciinae Dumortier and Lactucinae Dumortier, are already available (cf. Solbrig, 1963). My further reclassification of the Lactuceae includes three new subtribes based on the *Catananche–Hymenonema*, *Malacothrix*, and *Launaea–Sonchus* groups.

Catananche, *Hymenonema*, and *Rothmaleria* are regarded as isolated genera in the Lactuceae. They share involucral bracts with scarious margins, bristly-scaly to paleate receptacles, and a pappus of few large scales usually prolonged into stiff bristles. *Catananche* is circum-Mediterranean in distribution, *Hymenonema* occurs in Greece, and *Rothmaleria* in Spain. In a cladistic analysis of 23 genera of the Lactuceae and 23 morphological characters (Bremer, in press), the three genera *Catananche*, *Hymenonema*, and *Rothmaleria* consistently form a monophyletic group, occupying a phylogenetically basal position as sister group to most of the tribe. They are described here as a new subtribe, Catananchinae.

Stebbins (1953) described the subtribe Stephanomeriinae. He noted that the genera he included are rather diverse in habit and technical characters, and that there is no single diagnostic character for the subtribe. The Stephanomeriinae are entirely North American in distribution, and most of the species differ from most Old World Lactuceae by their echinate pollen grains. Stebbins divided his Stephanomeriinae into two rather different groups, the *Stephanomeria* group and the *Malacothrix* group. The latter comprises mostly few-branched, sometimes scapose annual herbs (*Anisocoma*, *Atrichoseris*, *Calycoseris*, *Glyptopleura*, *Malacothrix*; cf. Williams, 1957). They frequently have scarious-margined involucral bracts and bristly-scaly receptacles, and are in these features, but not in others, similar to the Catananchinae. The perennial *Pinaropappus* with a paleate receptacle is somewhat aberrant, but presumably related to *Malacothrix* (Jeffrey, 1966). The shrubby *Munzothamnus* (Raven, 1963), originally described as a species of *Stephanomeria*, is difficult to classify but is possibly more closely related to *Malacothrix* than to *Stephanomeria* and hence is possibly a specialized representative of the *Malacothrix* group. The position

of *Munzothamnus* must be regarded as tentative. In my cladistic analysis of the Lactuceae (Bremer, in press), both *Malacothrix* and *Stephanomeria* were included. The two genera never appeared together in the resulting cladograms, even though the position of *Stephanomeria* was very unstable. In Jansen et al.'s (1991) analysis of chloroplast DNA restriction site variation in the subtribe Microseridinae, *Stephanomeria* was included and appeared as nested within that subtribe. Stebbins's *Malacothrix* group is described here as a new subtribe Malacothricinae, separate from the Stephanomeriinae and the Microseridinae.

The *Launaea–Sonchus* group of Stebbins (1953) comprises two entities, *Launaea* with the related genera *Aetheorhiza* (Rechinger, 1974) and *Reichardia* (Gallego et al., 1980), and the *Sonchus* group of closely related genera (*Actites*, *Babcockia*, *Embergeria*, *Kirkianella*, *Lactucosonchus*, *Sonchus*, *Sventenia*, *Taeckholmia;* cf. Boulos, 1972, 1973, 1974a, b; Aldridge, 1976a, b; Lander, 1976). Many *Launaea* species share the compressed, nonbeaked fruits and the dimorphic pappus, consisting of intermixed bristles and fine hairs, typical of *Sonchus*. Hence it appears that the two subgroups are closely related and that the entire *Launaea–Sonchus* group is monophyletic. It has a scattered but very wide distribution with many *Sonchus* and *Launaea* species in Eurasia and throughout Africa. Several genera and species are restricted to the Canary Islands (*Babcockia*, *Lactucosonchus*, *Sventenia*, *Taeckholmia*); others occur exclusively in Australia (*Actites*) and New Zealand (*Embergeria*, *Kirkianella*). Stebbins included the *Launaea–Sonchus* group in his Crepidinae sensu lato, a highly polyphyletic taxon. The Crepidinae will be reclassified into four subtribes (Bremer, in press), Crepidinae sensu stricto, Hieraciinae, Lactucinae, and Sonchinae. In the cladistic analysis (Bremer, in press) *Sonchus* never grouped with the genera representing the three other subtribes. The Sonchinae are described here as a new subtribe.

Catananchinae K. Bremer, subtribus nov. TYPE: *Catananche* L.

Herbae annuae vel perennes. Bracteae involucri margine plus minusve scariosae. Receptaculum setosum vel paleaceum. Cypselae teretes vel subangulatae et obconicae, ecostatae, erostratae. Pappus e squamis ovato-lanceolatis, apice plerumque in setam scabrido-barbellatam prolongatis, constatus.

Annual or perennial herbs. Involucral bracts with ± scarious margins. Receptacle setose or paleate. Cypselas terete or subangular and obconical, without ribs and without beak. Pappus of ovate-lanceolate scales apically often prolonged into scabrid-barbellate bristles.

Mediterranean, eight species in three genera: *Catananche* L., *Hymenonema* Cassini, *Rothmaleria* Font Quer.

Malacothricinae K. Bremer, subtribus nov. TYPE: *Malacothrix* DC.

Herbae annuae vel interdum perennes. Bracteae involucri margine plerumque scariosae. Receptaculum vulgo squamosum, raro paleaceum. Cypselae tereti-fusiformes vel obovoideae, costatae, interdum rostratae. Pappus e setis tenuibus scabridis vel raro plumosis constatus vel raro nullus, extra saepe coronam minutam ferens.

Annual or sometimes perennial herbs. Involucral bracts often with scarious margins. Receptacle generally squamose, rarely paleate. Cypselas terete-fusiform or obovoid, ribbed, sometimes beaked. Pappus of slender, scabrid or rarely plumose bristles, or rarely absent, often surrounded by a minute corona.

North American, 33 species in 7 genera: *Anisocoma* Torrey & A. Gray, *Atrichoseris* A. Gray, *Calycoseris* A. Gray, *Glyptopleura* Eaton, *Malacothrix* DC., *Munzothamnus* P. H. Raven, *Pinaropappus* Lessing.

Sonchinae K. Bremer, subtribus nov. TYPE: *Sonchus* L.

Herbae annuae vel perennes, suffrutices vel frutices. Bracteae involucri herbaceae, interdum margine scariosae. Receptaculum nudum. Cypselae plus minusve compressae, ellipsoideo-fusiformes vel oblongo-obovoideae, leviter costatae, laeves vel rugulosae vel valde rugosae, interdum apice attenuatae, erostratae vel rarissime breviter rostratae. Pappus e setis scabrido-barbellatis vel saepe dimorphus e setis et pilis tenuibus mixtis constatus.

Annual or perennial herbs, subshrubs, or shrubs. Involucral bracts herbaceous, sometimes with scarious margins. Receptacle naked. Cypselas ± compressed, ellipsoid-fusiform or oblong-obovoid, slightly ribbed, smooth or rugulose to strongly rugose, sometimes attenuate apically, without beak or very rarely with a short beak. Pappus of scabrid-barbellate bristles or dimorphic of intermixed bristles and fine hairs.

Almost worldwide, mainly Eurasia and Africa, Canary Islands, also North America, Australia, and New Zealand, ca. 130 species in 11 genera: *Actites* Lander, *Aetheorhiza* Cassini, *Babcockia* Boulos, *Embergeria* Boulos, *Kirkianella* Allan, *Lactucosonchus* (Schultz Bipontinus) Sventenius, *Launaea* Cassini, *Reichardia* Roth, *Sonchus* L., *Sventenia* Font Quer, *Taeckholmia* Boulos.

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New Taxa and Nomenclatural Changes in *Allophyllum*, *Gilia*, and *Navarretia* (Polemoniaceae)

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ABSTRACT. Studies of certain species problems in *Allophyllum*, *Gilia*, and *Navarretia* resulted in the following nomenclatural changes: *Gilia* subg. *Kelloggia* is reduced to sectional status, two new species and one new subspecies are described (*Gilia lottiae*, *Navarretia myersii*, *N. hamata* subsp. *parviloba*), two subspecies are elevated to species (*Navarretia jaredii*, *N. rosulata*), one variety is elevated to subspecies (*N. nigelliformis* subsp. *radians*), and eight new combinations are proposed (*Allophyllum gilioides* subsp. *violaceum*, *Gilia brecciarum* subsp. *jacens*, *G. sinistra* subsp. *pinnatisecta*, *Navarretia leucocephala* subsp. *bakeri*, *N. leucocephala* subsp. *minima*, *N. leucocephala* subsp. *pauciflora*, *N. leucocephala* subsp. *plieantha*, and *N. intertexta* subsp. *propinqua*).

These changes are included in treatments of the same genera contributed by the author to the *Jepson Manual: Higher Plants of California* (Hickman, 1993).

This report is presented in order to validate nomenclatural changes found necessary during preparation of treatments of *Allophyllum*, *Gilia*, and *Navarretia* for the *Jepson Manual: Higher Plants of California* (Hickman, 1993). A more detailed account of studies that led to some of the decisions will be forthcoming elsewhere.

ALLOPHYLLUM (NUTTALL) V. GRANT

Allophyllum is a small genus occurring in the mountains of the western United States. All species are annual, the stems leafy, corollas short-or long-tubed, and blue, purple, pink, or white. Although segregated from *Gilia* by Grant & Grant (1955), it was maintained as a section of *Gilia* by Cronquist (1984).

Characters distinguishing *Allophyllum* from *Gilia* are its nonscapose habit, leafier stems, and distinctive trichome type (fine-stalked, gland-tipped), seeds generally boat-shaped, and leaf-lobes thickened at the tip, not fine-pointed as in *Gilia*.

Allophyllum violaceum (Heller) A. & V. Grant and *A. gilioides* (Bentham) A. & V. Grant are closely related species, with the former occurring generally at higher elevations. Typical *A. violaceum* occurs from 2,000 to 2,900 m in the high Sierra Nevada of California and in the mountains of western Nevada. The plants are small (generally 6–12 cm tall), have few-lobed leaves, and 2–3 flowers per cluster. *Allophyllum gilioides* occurs at lower elevations, mostly below 2,000 m; the plants are larger (14–60 cm tall), with larger, many-lobed leaves, and a glomerate inflorescence, 4–8 flowers per cluster. The two taxa intergrade in some areas at middle elevations (1,200–1,800 m) where their ranges overlap, as in Kern Canyon in the southern Sierra Nevada. Since a clear distinction between them is not possible throughout, I propose the following new combination.

Allophyllum gilioides (Bentham) A. & V. Grant subsp. **violaceum** (Heller) Day, comb. et stat. nov. Basionym: *Gilia violacea* Heller, Muhl. 1: 56. 1904. *Allophyllum violaceum* (Heller) A. & V. Grant, Aliso 3: 106. 1955. *Gilia gilioides* Bentham var. *violacea* (Heller) Cronq., Intermountain Flora 4: 132. 1984. TYPE: U.S.A. California: Nevada Co., lower end of Donner Lake, *Heller 6873* (holotype, DS; isotypes, NY, UC).

GILIA RUIZ & PAVÓN

The total number of species of *Gilia* sensu stricto (excluding *Ipomopsis*) is ± 70, of which 9 are South American. In North America the genus is confined to the western states, with the greatest concentration of species in California, which has 47 of the approximately 60 species, as treated for the *Jepson Manual*. In this work the species are grouped in six sections: *Arachnion*, *Gilia*, *Giliandra*, *Giliastrum*, *Kelloggia*, and *Saltugilia*. This is modified from the sectional arrangement of Grant (1959), especially in the addition of the new section *Kelloggia*.

Two species groups were originally included in *Gilia* sect. *Saltugilia* V. & A. Grant: the *G. splendens* group and the *G. leptalea–G. capillaris* group (Grant & Grant, 1954). New studies show that *G.*

capillaris Kellogg and *G. leptalea* (A. Gray) E. Greene are so different from the *G. splendens* group in habit, leaf form, and trichome type, as well as pollen morphology, that they constitute a disparate element in *Gilia* sect. *Saltugilia*, and should be placed elsewhere. Since no existing section is suitable, a new section, *Kelloggia*, reduced from *Gilia* subg. *Kelloggia* H. Mason & A. D. Grant, is proposed.

Of the four species included in *Gilia* subg. *Kelloggia*, only *G. capillaris* and *G. leptalea*, plus a segregate species, *G. sinistra* M. E. Jones, are retained in section *Kelloggia*. The remaining species from subgenus *Kelloggia* are placed elsewhere: *G. tenerrima*, appearing close to *G. inyoensis*, is more suitably placed in section *Giliastrum;* and *Gilia minutiflora* has been transferred to *Ipomopsis* (*I. minutiflora* (Bentham) V. Grant).

Gilia sect. **Kelloggia** (H. Mason & A. D. Grant) Day, stat. nov. Basionym: *Gilia* subg. *Kelloggia* H. Mason & A. D. Grant, Madroño 9: 219. 1948, as to type, but not as to all species included. TYPE: *Gilia capillaris* Kellogg.

Erect annuals. Plants glandular-puberulent or partly glabrous, the glands minute and black. Leaves mostly cauline, linear to narrowly elliptic, tapered proximally and distally, lower leaves generally few or rarely numerous, but not in a definite rosette, entire or rarely pinnately lobed, upper leaves entire or digitate with 2–4 small lobes. Inflorescence loose, 1–3 flowers above a leaf, pedicels filiform. Calyx tubular in lower half, glabrous or glandular-puberulent, splitting in sinuses at maturity; corolla funnelform. Stamens attached in upper throat, slightly exserted to well exserted, pollen blue. Style included or exserted. Capsule equal to or more often shorter than calyx, valves splitting to base at maturity; seeds 1–6 per cell, mucilaginous when wet.

Gilia sinistra M. E. Jones, a little known segregate of *G. capillaris*, is a small-flowered species distinguished from the latter by frequently digitate (rather than entire) leaves, acute (not acuminate) calyx lobes, glabrous (not puberulent) corolla tube, and pink (not pale blue) corolla lobes. The two species have been found growing together in a number of localities in the Sierra Nevada, yet in all instances they appeared entirely distinct.

A larger-flowered taxon, closely related to *G. sinistra* and differing in little else besides corolla size, was described as a subspecies of *G. leptalea*. A new combination, proposed here, transfers it to *G. sinistra*.

Gilia sinistra M. E. Jones subsp. **pinnatisecta** (Mason & A. D. Grant) Day, comb. nov. Basionym: *Gilia leptalea* (A. Gray) E. Greene subsp. *pinnatisecta* Mason & A. D. Grant, Madroño 9: 220. 1948. TYPE: U.S.A. California: Lake County, *Baker 2299a* (holotype, UC).

Gilia brecciarum M. E. Jones subsp. **jacens** (A. & V. Grant) Day, comb. et stat. nov. Basionym: *Gilia jacens* A. & V. Grant, Aliso 4: 437. 1960. TYPE: U.S.A. California: Kern/Ventura Co. line, between Stauffer Jct. and Mt. Pinos, *V. Grant 9980* (holotype, RSA).

Experimental crosses between *Gilia jacens* and *G. tenuiflora* Bentham resulted in semifertile hybrids (Grant & Grant, 1960). A close relationship between these two species was also inferred because of their similar corolla shape and color, with the throat generally flaring and entirely or in part dark purple.

The probable origin of *Gilia jacens* from *G. tenuiflora* has been postulated by Grant (1971, 1981). A reexamination of *G. jacens* in the herbarium, however, shows that it differs from *G. tenuiflora* in ways that suggest it has a closer affinity with *G. brecciarum*, especially subspecies *brecciarum*.

Thus, *Gilia jacens* and *G. brecciarum* subsp. *brecciarum* share the following characters: (1) stems densely cobwebby near the base (*G. tenuiflora* stems at base are generally glabrous to slightly pubescent); (2) flowers and fruits in clusters (*G. tenuiflora* flowers and fruits are not clustered, or only slightly so); and (3) calyx ribs densely pubescent, their width exceeding the membrane (*G. tenuiflora* calyx ribs are generally slightly pubescent and narrower than the membrane).

Gilia jacens is distinguished from *G. brecciarum* subsp. *brecciarum* by its long decumbent branches, rather finely cut leaves, and generally small corolla with throat often included. However, the two taxa are often difficult to distinguish, as in the Tehachapi and Piute Mountains of southern California, where they intergrade.

It appears that *Gilia jacens* is a close relative of *G. brecciarum* subsp. *brecciarum* that may have undergone some introgression from the *G. tenuiflora* species group. The decision to transfer it to *G. brecciarum* as a subspecies reflects this view of its relationships.

Gilia lottiae Day, sp. nov. TYPE: U.S.A. Nevada: Churchill Co., Hot Springs Mountains, 11.5 mi. N of Hazen on Pole-line Road, 8 May 1980, *Day & Lott 80-36* (holotype, CAS; isotype, RSA). Figure 1.

Gilia leptomeria A. Gray var. *myriacantha* M. E. Jones, Contr. W. Bot. 12: 53. 1908. TYPE: U.S.A. California: San Bernardino Co., Needles, *Jones 9868* (holotype, POM).

Annua glanduloso-puberula. Folia radicalia rosulata applanate, ± succulenta, dentata vel pinnatifida, supra glabra, venis subtus glandulosis puberulis et areniferis, rachidibus latis, folia caulina integra. Inflorescentiae immaturae nutantes. Calycis membrana affixa prope apices calycis loborum. Corolla 4–7 mm longa, tubo exserto, fauce luteo, fauce tubum aequilonge vel longiore, lobis lanceolatis vel ovatis, acutis vel acuminatis, integris, roseis vel lavendulis vel albis. Pollen album. Stamina et stylus parum exserta. Capsula ovoidea, 3–5 mm longa, capsula calyx 1.2–1.5-plo longior. Semina multa, sub aqua immutata. Habitatio arenacea. $n = 25$, aliquando $n = 16$.

Plants 5–43 cm high, glandular-puberulent. Stems 1–numerous, spreading from base. Basal leaves 2–11 cm long in flat rosette, bright green, succulent in vigorous plants, ± widely strap-shaped, glabrous and shining above, with veins on lower surfaces glandular-puberulent and sand-dotted, dentate or pinnately lobed, lobes generally entire, spreading, cuspidate, shorter than width of rachis, upper leaves entire, linear or sublinear. Inflorescence nodding and clustered in bud, becoming erect, loose, many-branched. Calyx lobes acute, bordered by membrane nearly to apex; corolla 4–7 mm long, tube glabrous, stout, generally exserted, throat tapered and as long as or longer than tube, yellow, lobes lanceolate to narrowly ovate, acute to acuminate, entire, pink, lavender, or white; pollen white, stamens and style slightly exserted. Capsule 3–5 mm long, 1.2–1.5 × calyx, ovoid. Seeds many, not mucilaginous when wet. $n = 25$, sometimes $n = 16$.

Distribution. California, Mojave Desert (Clark Mts.) to the desert slopes of the Sierra Nevada, to eastern Washington, Idaho, Utah, and Arizona, 400–2,100 m elevation. Habitat usually deep sand.

Gilia lottiae is a member of the *G. leptomeria* complex and a segregate of *G. leptomeria* A. Gray, from which it is distinguished by its broad basal leaves with upper surface glabrous and shining (not puberulent), its long-tapered (not short) corolla throat, its attenuate and entire (not mucronate) corolla lobes (Fig. 1), and its usually hexaploid chromosome number. This chromosome number, $n = 25$, was first reported by Grant & Latimer (in Grant, 1959). The voucher, listed with the paratypes below, is *V. & A. Grant 9821* (RSA).

The tetraploid race of *G. lottiae* ($n = 16$) differs only slightly from the hexaploid, with the corolla tube shorter, included in the calyx, and corolla lobes erose, not entire. Its chromosome number, $n = 16$, is new for *Gilia*, having not been previously reported for the genus.

Gilia lottiae is named posthumously for Patricia Lott of Fallon, Nevada, whose freely offered assistance as a guide and plant-hunter was valued and deeply appreciated.

Paratypes. U.S.A. **Idaho:** Butte Co., 13 m NE of Arco, *Hitchcock & Muhlick 21303* (DS). **Oregon:** Malheur Co., ca. 4 m NW of Harper, Twp. 19 S, R 41 E, ca. S 23, *Cronquist 7833* (DS); Lake Co., 7 m SW of Wagontire, *J. T. Howell 28727* (CAS). **Nevada:** Humboldt Co., Winnemucca, *V. & A. Grant 9821* ($n = 25$; RSA); Churchill Co., 25 m S of Fallon, Walker River Indian Reservation, Rawhide Rd., 28 Apr. 1978, *Day & Lott 78-18* ($n = 25$; CAS); 6.1 m N of Fallon, Indian Lakes Rd., 29 Apr. 1978, *Day & Lott 78-33* ($n = 25$; CAS); 5 m SE of Hazen, side-rd. off Hwy. 50, Swingle Bench, 22 May 1979, *Day & Lott 79-35.8* ($n = 25$; CAS); 6.4 m N of Hazen on pole-line rd., 8 May 1980, *Day & Lott 80-27* ($n = 16$, CAS, RSA); Washoe Co., along rd. from Bedell Flat to Warm Springs Valley, *Tiehm, Lott & Williams 2112* (CAS). **California:** Mono Co., Rough Creek between Potato and Bodie mountains, *Hardham 15116* (CAS); Inyo Co., Eureka Valley, *DeDecker 3173* (CAS); San Bernardino Co., W of Clark Mts. on Cima Rd., 0.8 m N of road to Coliseum Mine, *Day & Malley 82-14* (CAS); Los Angeles Co., just outside Saddleback Butte State Park, *Keil et al. 12323* (CAS).

Navarretia Ruiz & Pavón

The dense heads of *Navarretia*, with their spinose bracts, contain characters often critical in the solution of taxonomic problems in the genus. This is

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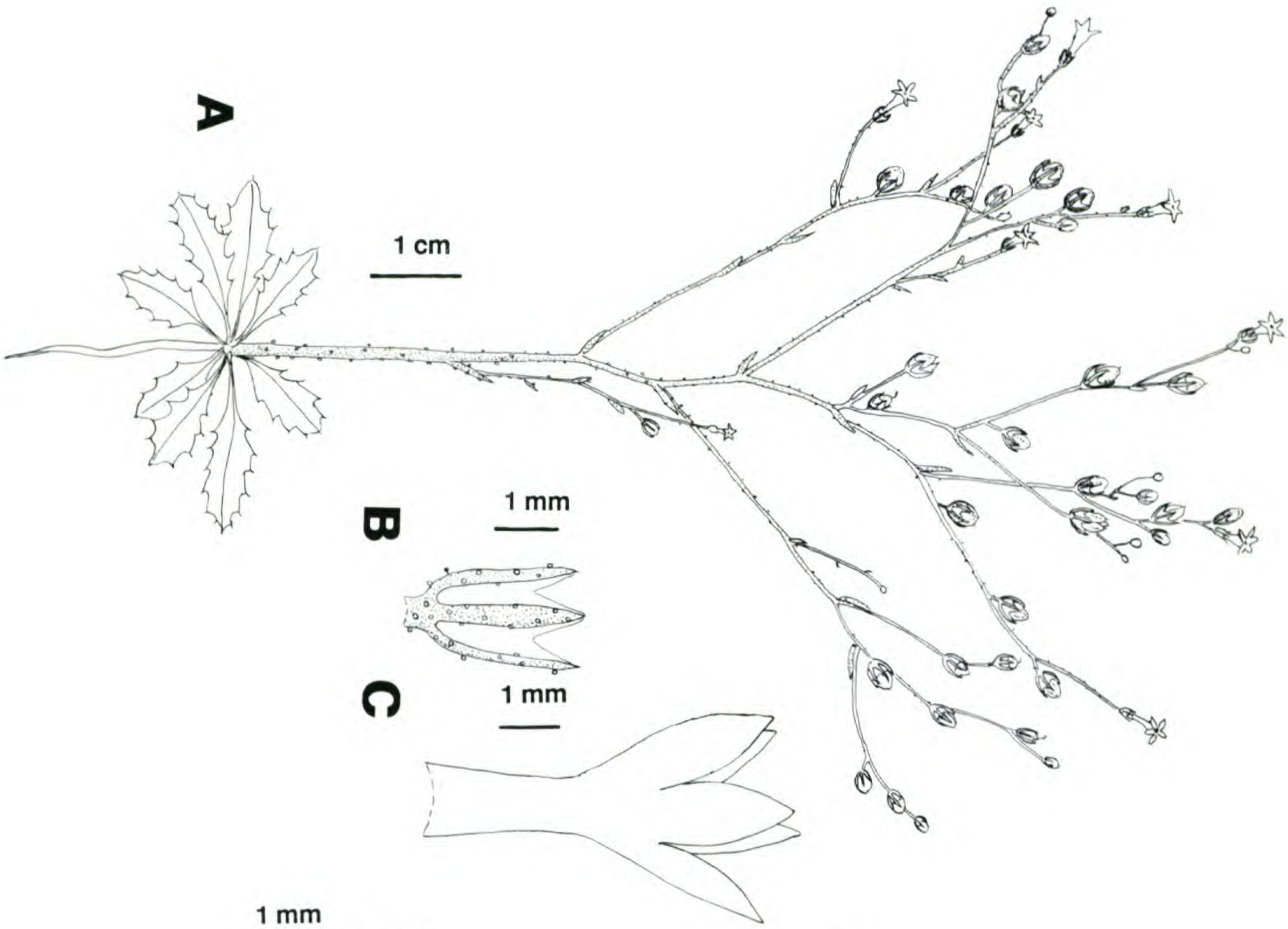
Figure 1. A–D, *Gilia lottiae* Day (*Day & Lott 79-39*, CAS). —A. Habit of plant in flower and fruit. —B. Calyx. —C. Corolla. —D. Mature calyx and capsule. E–G, *G. leptomeria* (*Day 82-27*, CAS). —E. Calyx. —F. Corolla. —G. Mature calyx and capsule.

Figure 2. A–D, *Navarretia atractyloides* (Bentham) Hooker & Arnott (*Day 89-2*, CAS). —A. Lower leaf. —B. Outer bract. —C. Calyx. —D. Corolla segment with stamens and style. E, F, H, J, *N. hamata* subsp. *parviloba* (*Day 92.1*, CAS). —E. Lower leaf. —F. Outer bract. —H. Calyx. —J. Corolla segment with stamens and style. G, *N. hamata* subsp. *hamata* (*Roos 30 June 1965*, RSA). —G. Corolla segment with stamens and style.

A



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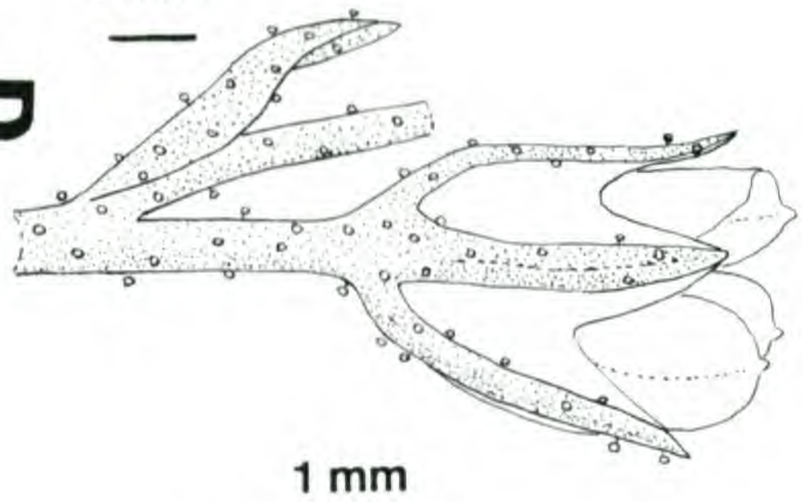

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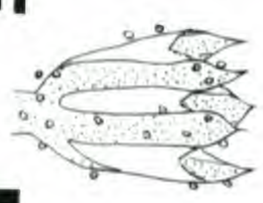

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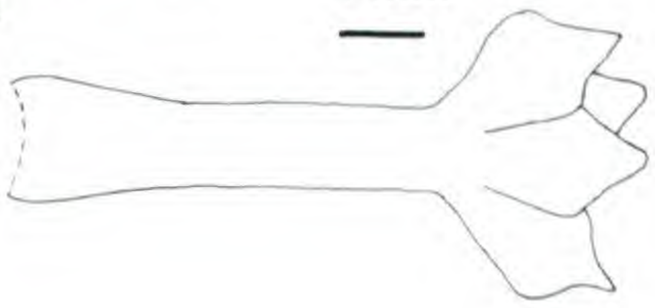

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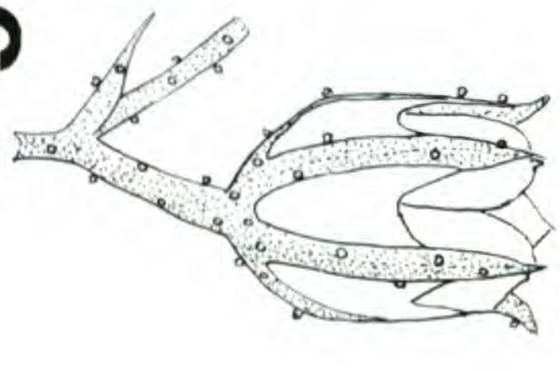

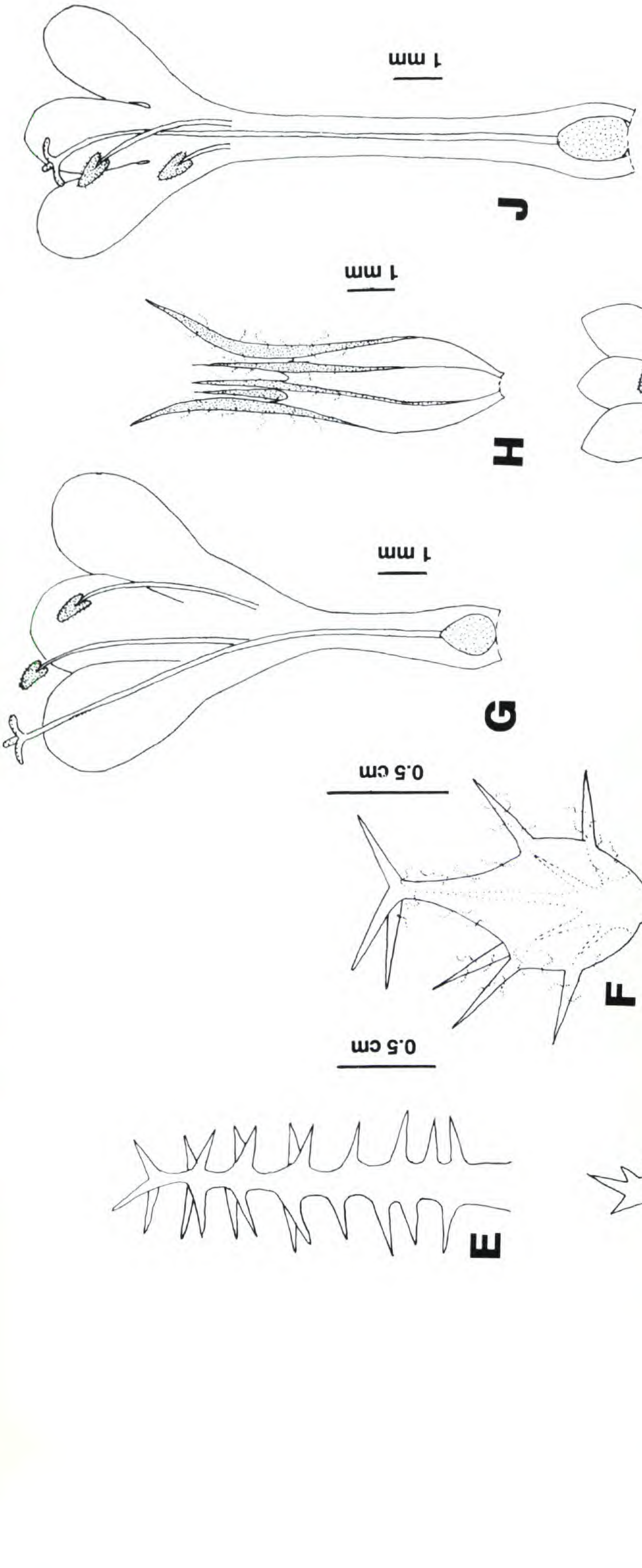
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well demonstrated by the key to *N. atractyloides* (Bentham) Hooker & Arnott and *N. hamata* E. Greene, as these two species are separated on bract (and leaf) form. Bract characters are also important in the identification of the newly described *N. hamata* subsp. *parviloba*.

Navarretia hamata E. Greene subsp. **parviloba** Day, subsp. nov. TYPE: U.S.A. California: Santa Cruz Co., Ben Lomond, 18 July 1962, *Rose 62073* (holotype, CAS; isotypes, DS, RSA). Figure 2.

Affinis subsp. *hamatae* sed differt a fauce et lobis corollae angustis, et a subsp. *leptantha* (E. Greene) H. Mason tubo corollae incluso, ambo spinis ternis terminalibus foliorum et bractearum externarum aequalibus divaricatis rectangulatis, bracteis externis villosis plerumque non glandulosis, lobis corollae sublazulinis vel lavendulis, staminibus brevibus.

Plants not mephitic. Leaves pinnate with lobes spreading at right angles, lobes spinose, entire or forked. Rachis of lower leaves linear, cauline leaf rachis linear to lanceolate, narrowed below a terminal, 3-lobed hook; lobes of hook equal, widely divergent, middle lobe markedly recurved. Heads terminal on main stems and axillary branches; outer bracts long-hairy, generally nonglandular, bearing terminal hooks as on the cauline leaves; calyx lobes entire or the largest lobes toothed; corolla 8–14 mm, tube white, lobes 2–3 mm long, pale blue or lavender; stamens and style included in tube or slightly exserted.

Distribution. California, southern Santa Cruz Mountains (Santa Cruz Co.) to Ventura County in the South Coast Ranges, 30–1,000 m. Openings in chaparral, in firm sand, or sand and gravel, and on sand hills.

Navarretia hamata subsp. *parviloba* occurs as far north as the Santa Cruz Mountains, whereas subspecies *hamata* and *leptantha* are restricted to southern California and Baja California, Mexico. It differs from subspecies *hamata* in its paler corolla with narrower throat and smaller lobes, and in its shorter stamens and style.

In Los Angeles County where the ranges of subspecies *parviflora* and *hamata* overlap, subspecies *hamata* varies toward subspecies *parviloba* in leaf and bract form, with bract lobes tending to be equal, and the leaf axis widely lanceolate. This apparently introgressive form of subspecies *hamata* can still be distinguished by its brightly colored corolla with a wide throat.

Hoover (1970) first reported the existence of an undescribed northern race of *Navarretia hamata* with paler corolla, but did not give it a subspecific name. He also called attention to an error in which this taxon was represented in a key and in a drawing as *N. atractyloides* (Mason in Abrams, 1951). The flowers of *N. hamata* subsp. *parviloba* and of *N. atractyloides* are similar in having small corolla lobes, but in bract shape and leaf form the two are quite different, as shown in the key and in Figure 2. They are often found growing together; consequently numerous mixed gatherings are encountered in the same herbarium collections. They are partially isolated seasonally: *N. hamata* subsp. *parviloba* is generally found in late flower and fruit when *N. atractyloides* is in vegetative condition or early flower.

Paratypes. U.S.A. **California:** Santa Cruz Co., near Jamison Rd. and Boulder Creek–Big Basin Highway, 15 July 1953, *Thomas 3500* (DS, RSA); Monterey Co., Pacific Grove, pine woods, 25 May 1903, *Heller 6782* (DS, POM); San Luis Obispo Co., 3 mi. NW of Nipomo, 11 July 1964, *Hoover 9178* (CAS); Ventura Co., Santa Susana Pass, 30 June 1928, *J. Howell 1017* (RSA).

KEY TO *NAVARRETIA ATRACTYLOIDES* AND *N. HAMATA*

1a. Upper leaves and outer bracts tipped with 3 antrorse, parallel lobes; terminal lobe longest, slightly downcurved ..... *N. atractyloides*
1b. Upper leaves and outer bracts tipped with 3 divergent lobes; terminal lobe equal to or slightly longer than adjacent lobes, and markedly recurved ..... *N. hamata*
  2a. Stamens short, slightly exserted; bracts generally not glandular; lobes at tip equal; corolla lobes white to lavender, aging blue ..... subsp. *parviloba*
  2b. Longest stamens exceeding corolla lobes; bracts glandular; terminal lobe equal to or longer than adjacent lobes; corolla lobes bright pink to purple.
    3a. Corolla tube included, throat wide, lobes ovate; cauline leaf axis linear to widely lanceolate ..... subsp. *hamata*
    3b. Corolla tube well exserted, throat narrow, lobes linear to narrowly ovate; cauline leaf axis linear ... subsp. *leptantha*

Navarretia intertexta (Bentham) Hooker subsp. **propinqua** (Suksdorf) Day, comb. et stat. nov. Basionym: *Navarretia propinqua* Suksdorf, Allg. Bot. Z. Syst. 12: 26. 1904. *Navarretia intertexta* (Bentham) Hooker var. *propinqua* (Suksdorf) Brand, Pflanzenr. 4 (250): 163. 1907. TYPE: U.S.A. Washington: Spokane Co., Falcon Valley, *Suksdorf 2700* (NY).

This taxon is a lower-growing, procumbent relative of the typically erect *Navarretia intertexta*. Subspecies *propinqua* differs also in its smaller flowers and shorter, nearly glabrous (not hairy) bracts.

It is the predominant subspecies of *N. intertexta* east of the summits of the Cascade Range and the Sierra Nevada from Washington to California and east to Montana, Wyoming, Colorado, and Arizona.

The characters distinguishing subspecies *propinqua* are inconstant, because intermediate specimens are occasionally seen. For example, plants with the compact habit of subspecies *propinqua* sometimes have densely hairy heads or larger bracts as in subspecies *intertexta*. Hence, I am in agreement with Brand, who regarded the two taxa as conspecific, but elevate Brand's variety *propinqua* to subspecific level for consistency in the treatment of this genus for the *Jepson Manual.*

The *Navarretia leucocephala* group is viewed here as including five species: *N. fossalis* Moran, *N. involucrata* Ruiz & Pavón (South America), *N. leucocephala* with four subspecies, *N. myersii* P. S. Allen & Day, sp. nov., and *N. prostrata* (A. Gray) E. Greene. All species are adapted to a vernal pool habitat, germinating while submerged and completing their life cycle after the water recedes.

These are plants of intriguing but cryptic variability. The treatment advocated here differs from some previous works in that *Navarretia bakeri, N. minima, N. pauciflora,* and *N. plieantha* are reduced to subspecies under *N. leucocephala.* This step was undertaken after it became evident that intermediates exist between certain of these species as well as with typical *N. leucocephala* where their ranges overlap. An exception is *N. myersii,* which is similar to but distinct from *N. leucocephala.*

The southern California species *Navarretia prostrata* and *N. fossalis* show no evidence of intergrading with each other. Generally their ranges do not coincide, but one possible case of sympatry is evident from the following two cited collections, which are clearly distinct: California: Riverside County, Rancho California, Mesa de Burro, *R. F. Thorne et al. 45563* (UC) (*N. prostrata*); same general locality, *Thorne & Lathrop 47317* (UC) (*N. fossalis*).

Navarretia leucocephala Bentham, Pl. Hartwegianae 324. 1849. TYPE: U.S.A. California: Sacramento Valley, *Hartweg 247* (holotype, K).

Navarretia leucocephala Bentham subsp. **bakeri** (H. Mason) Day, comb. et stat. nov. Basionym: *Navarretia bakeri* H. Mason, Madroño 8: 198. 1946. TYPE: U.S.A. California: Lake Co., Lower Lake, 28 June 1945, *H. Mason 12599* (holotype, UC).

Navarretia leucocephala Bentham subsp. **minima** (Nuttall) Day, comb. et stat. nov. Basionym: *Navarretia minima* Nuttall, Proc. Acad. Nat. Sci., Philadelphia 4: 13. 1848. *Gilia minima* (Bentham) A. Gray Proc. Amer. Acad. Arts 8: 269. 1870. TYPE: U.S.A. Washington: near Walla Walla, plains of the Oregon, *Nuttall s.n.* (holotype, BM).

Navarretia leucocephala Bentham subsp. **pauciflora** (H. Mason) Day, stat. et comb. nov. Basionym: *Navarretia pauciflora* H. Mason, Madroño 8: 200. 1946. TYPE: U.S.A. California: Lake Co., 5 m N of Lower Lake, 12 May 1945, *H. Mason 12583* (holotype, UC; isotypes, CAS, UC).

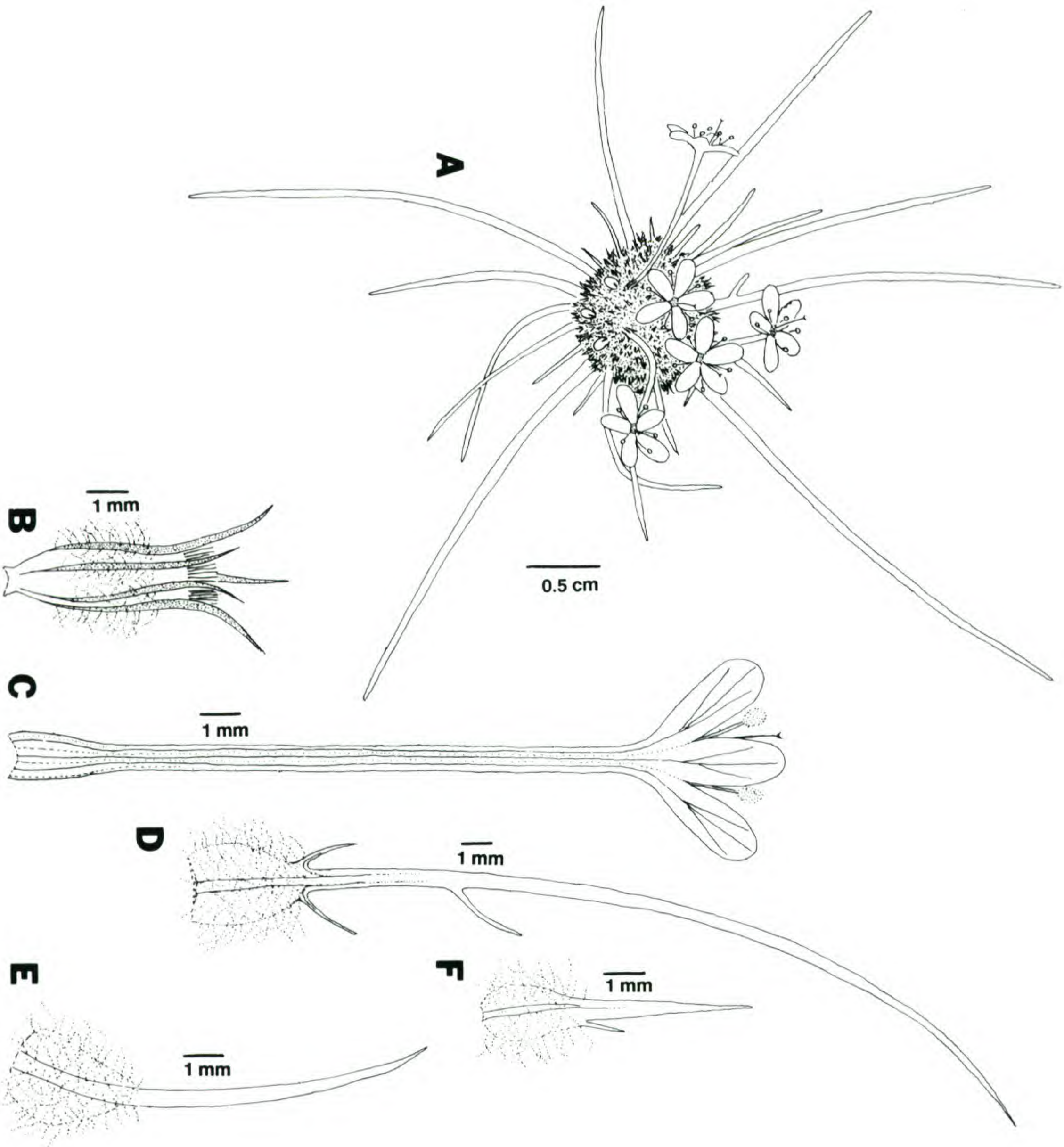
Navarretia leucocephala Bentham subsp. **plieantha** (H. Mason) Day, stat. et comb. nov. Basionym: *Navarretia plieantha* H. Mason, Madroño 8: 199. 1946. TYPE: U.S.A. California: Lake Co., Mt. Hanna, NW slope, Boggs Lake, 29 June 1945, *H. Mason 12628* (holotype, UC).

The following new species, related to *N. leucocephala* but differing in some striking details, was discovered by Perry Allen. Mr. Allen sent the specimens, here designated as the type, with a description from living plants and cooperated further in fieldwork relating to this study.

Navarretia myersii P. S. Allen & Day, sp. nov. TYPE: U.S.A. California: Merced Co., 13 m NE of Merced, near Mariposa Co. line, Myers (Flying M) Ranch, 4 May 1982, *Perry S. Allen s.n.* (holotype, CAS; isotype, US). Figure 3.

Navarretia leucocephalae affinis sed planta matura prostratum, folia longiuscula, ± curva, pauciloba, capitulum plerumque solitarium, receptaculum incrassatum, alae bractearum villosae, flores sessilis, costae calycis villosae, corolla 12–21 mm longa, tubus filiformis, 2–4 × calycem.

Herbaceous annual, 1–3 cm high, becoming stiffly spinose in maturity, generally with a single prostrate, moundlike head 1–2 cm diam., rarely with 1–2 small secondary heads arising on lateral branches from below. Stem 0–20 mm long, puberulent with recurved hairs or glabrous. Cauline leaves, if present, opposite at base, alternate above. Involucral leaves numerous, radiating, curved, 2–4 × as long as diameter of the head, nearly entire or few-lobed near base, winged near base, wings membranous, ciliate or glabrous, imbricate; outer bracts well exceeding head, broadly winged, wings densely villous, with generally 2–4 lobes near base, and often 2 near middle, entire, or basal lobes forked, terminal lobe elongate; inner bracts few, mostly near periphery of head, 5–8 mm long, slightly exceeding calyces, entire or 2–4-lobed, villous and winged; wing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ciliate. Inflorescence 5–60-flowered, receptacle thickened with maturity; flowers sessile upon receptacle, crowded, arising successively 1–4 in bract axil. Calyx 4–6 mm long, villous about middle, ciliate in orifice, lobes glabrous, linear, generally entire, slightly outcurved, membrane truncate, ciliate. Corolla 17–21 mm long, cream-white, salverform, tube filiform, 12–16 mm long, 2–4× calyx, throat short, constricted, lobes 2.5–3 mm long, oblong to narrowly ovate, spreading, with a single vein entering base and 0–2 branch veins above. Stamens attached just below sinuses, exserted, unequal, longest exceeded by corolla lobes, pollen yellow. Style well-exserted, generally equal to or exceeding corolla. Capsule ± 2 mm long, broadly ovoid, obscurely 2-celled, membranous, sticking to seeds until wet, valves separating in lower half when wet. Seeds 2–4, reddish brown, ovoid, erect in the cells, finely reticulate-pitted, sticking together, mucilaginous and separating when wet.

Distribution. Known from only a few localities at the border between the Central Valley and Sierra Nevada foothills in Sacramento, Amador, and Merced counties. A rare endemic, *Navarretia myersii* occurs in moist or dried beds of shallow vernal pools. Soil type at the type locality is, according to Perry Allen, Hornitos series, strongly acidic.

Corolla tube length in *Navarretia myersii* is greatest at the type locality, as compared with plants seen in the other cited stations. In the latter plants the corolla tube is well exserted but not to the extreme found in the type collection (Fig. 3).

The species is named for John W. Myers, owner of the Flying M Ranch, the type locality of *Navarretia myersii.* This is in recognition of his persistence in protecting the area from overgrazing and other potential environmental disturbances, and for courtesies extended to interested botanists of several California research and conservation organizations.

Paratypes. U.S.A. **California:** E Merced Co., Flying M Ranch (type locality) 15 May 1984, *Day & R. P. Allen 84-2* (CAS), 17 Apr. 1985, *Day et al 85-18* (CAS), *Ertter 8272* (UC); Sacramento Co., California Dept. of Fish and Game Phoenix Field Ecological Reserve, 4 Apr. 1981, *Holland 1026* (CAS), 29 Apr. 1988, *Day & P. S. Allen 88-10* (CAS); Amador Co., 4 May 1922, *Otis 1197* (DS); 5 mi. W of Ione on rd. to highway 16, 10 May 1941, *Heller 16114* (UC).

Navarretia nigelliformis E. Greene subsp. **radians** (J. Howell) Day, stat. nov. Basionym: *Navarretia nigelliformis* E. Greene var. *radians* J. Howell, Leafl. W. Bot. 2: 136. 1938. TYPE: U.S.A. California: San Benito Co., 12 mi. S of Paicines, 20 May 1937, *Howell 12962* (holotype, CAS; isotype, JEPS).

The elevation of *Navarretia nigelliformis* var. *radians* to subspecific level is for consistency in the *Jepson Manual* treatment of the genus. Recent information, however, suggests that an alternative disposition may be necessary in the future, since subspecies *radians* is now known to be sympatric with typical *N. nigelliformis* in at least one area, without any evident intergradation.

This observation is based on collections made in 1985 and 1986 from a population of these taxa on the eastern border of the Coast Ranges in western Merced County, California, along the North Fork of Los Banos Creek by Lacy & Hurt (nos. 51 and 88, at CAS), and by Janeway & Janeway (nos. 1610, 1617, 1677, 1688, 1690, and 1691, also at CAS).

Because of its multiple seeds and purple-spotted corolla throat, *Navarretia nigelliformis* subsp. *radians* keys to *N. nigelliformis,* yet in other characters, such as its spreading habit, smaller flower size, and grayish hairy heads, it resembles *N. heterandra* H. Mason. The relationships of this group of taxa are currently under study.

Acknowledgments. I thank Frank Almeda (CAS) for critically reading the manuscript and for helpful suggestions. Thanks are due also to Dieter Wilken (SBBG) for his comments as reviewer and to Thomas Daniel (CAS) and John Thomas Howell (CAS) for discussions on a number of points. For assistance with the Latin diagnoses I thank Mr. Howell and Diana Lusk. The illustrations were drawn by the author. These studies were done largely at the California Academy of Sciences (CAS), but were also continued at the Smithsonian Institution (US) and the University of California, Berkeley (UC). I am grateful to the staff of these institutions for the many courtesies extended.

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Figure 3. *Navarretia myersii* P. S. Allen & Day, drawn from topotype material (*Day et al. 85-18,* CAS). —A. Habit of plant in bud and flower. —B. Calyx. —C. Segment of corolla. —D, E. Outer bracts.—F. Inner bract.

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New Species and a New Combination in *Mabea* (Euphorbiaceae) from South America

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ABSTRACT. Five species of *Mabea* new to science are proposed and distinguished from their relatives, based to a large extent on characters of pistillate flowers and leaves. All have a limited distribution. Another species is reduced to a subspecies of *M. fistulifera*.

Mabea Aublet is a neotropical genus of Euphorbiaceae that has its greatest diversity in the Amazon region. It comprises approximately 40 species, some of which are new to science and are described herein. Useful diagnostic characters for the genus are the six-parted calyx of pistillate flowers (other numbers of sepals rarely reported, mostly for single plants), the irregularly but mostly five-parted calyx of staminate flowers, the persistent and dense pubescence of the pistillate flowers and fruits, and the peculiar dendritic type of hairs. Other characters cited in older literature do not cover all species of *Mabea* (e.g., long pedicels and styles) or are not useful at all.

In distinguishing the species of *Mabea*, characters of pistillate flowers (e.g., sepals and color of pubescence) and leaves (e.g., venation and glands) are most useful in many cases. Fruits, seeds, and staminate flowers, on the other hand, often are quite uniform. A revision including a more detailed discussion will be published later.

Mabea arenicola Esser, sp. nov. TYPE: Brazil. Amazonas: basin of Rio Negro, road Camanaus–Uaupés, near Camanaus, 2 Nov. 1971 (fl), *G. T. Prance, P. J. M. Maas, P. B. Woolcott, O. P. Monteiro & J. F. Ramos M15993* (holotype, NY; isotypes, F, S, U, W). Figure 1.

Arbor *M. speciosae* Mueller Argoviensis affinis sed thyrsis non nisi 15–20 mm latis (1–)2(–4) floribus femineis instructis, stylis 6–10 mm longis, glandibus bractearum florum masculinorum plerumque distincte elevatis, laminis foliorum glabris differt.

Tree up to 10 m tall, sometimes climbing. Twigs glabrous. Leaf blades elliptical to oblong, (11–)14–19 cm long, (5–)6–8 cm wide, apically acuminate (acumen at least as long as wide, often twice as long as wide), basally obtuse to rounded, indistinctly serrate to entire; secondary veins below the acumen in 14–17(–19) pairs, clearly brochidodromous; glabrous; abaxially glaucous because of cuticular folds, only larger veins excepted; marginal nectar glands 5–20 on each half of blade, 0.35–0.55 mm diam., situated abaxially a little away and separated from the marginal sclerenchyma. Petioles 11–15 mm long, glabrous. Stipules not known. Thyrses yellowish to reddish, mostly compound; staminate part 4–8 cm long, 15–20 mm diam., axis with few short (≤ 0.1 mm) rarely branched hairs. Glands of bracts of staminate cymules always elevated, mostly by their own length, length of glands 2 mm; cymules 3(–7)-flowered, pedicels 3–5 mm long, free; stamens up to 30 per flower. Pistillate flowers (1–)2(–4); bracts glandless or with glands smaller than those of distal bracts; pedicel 5–8 mm long, in fruit up to 22 mm; sepals glandless, up to 2.5 mm long, not extending beyond ovary, not divided; ovary brownish pubescent; style 6–10 mm, in fruit up to 12 mm long. Fruits 16 mm long; shape unknown. Seeds 9 mm long, 7.5 mm wide, 6.5 mm deep, slightly carunculate.

Mabea arenicola is known from widely separated localities of northwestern Amazonia. It is a species of noninundated, woody vegetation on white sands, i.e., the "caatingas" of the upper Rio Negro. Collected in flower March to May, September, November; in fruit March to May, July, November.

Vernacular names: marima, rebentillo.

Mabea arenicola is most closely related to *M. speciosa* Mueller Argoviensis. Its type specimens have been distributed as *M. caudata* Pax & K. Hoffmann, which is a synonym of *M. speciosa*.

Without flowers *Mabea arenicola* is hardly distinguishable from *M. speciosa*. The leaves are always glabrous and thus are different from typical *M. speciosa*, but fall within the range of variation of that species. *Mabea arenicola* differs from *M. speciosa* most remarkably by the discontinuously narrower diameter of the staminate part of the thyrses. Other differences include: the bracteal glands of the staminate cymules are more elevated from

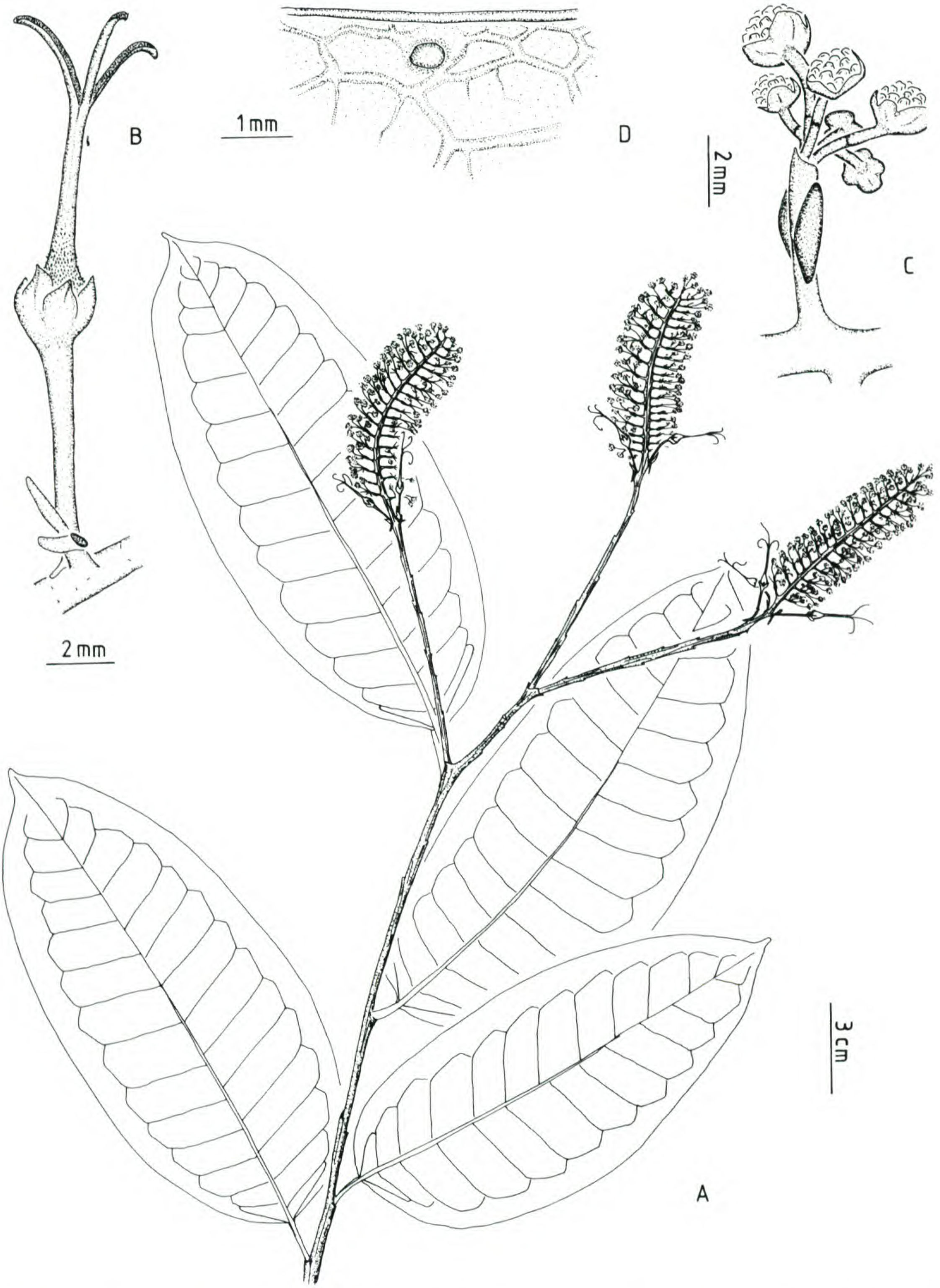

Figure 1. *Mabea arenicola* Esser. —A. Habit. —B. Pistillate flower. —C. Staminate cymule. —D. Portion of abaxial leaf margin showing glands. (All drawn from the type collection, *Prance et al. 15993*.)

the inflorescence axis in *M. arenicola* than in *M. speciosa* (hardly elevated only in *Liesner 3786*); there are fewer pistillate flowers per thyrse in *M. arenicola* than in *M. speciosa*. Whereas many-flowered staminate cymules are rare in *M. speciosa*, they are quite common in *M. arenicola*. This last character occurs in more than half of the specimens of *M. arenicola*, but can vary within one specimen. Furthermore, the number of stamens per staminate flower of *M. arenicola* is smaller than is the case in *M. speciosa* with ca. 40–60 stamens; however, the variability of stamen number has been underestimated in the past and should be used with caution. The apically mucronate to rounded leaves of *M. subserrulata* Spruce ex Bentham, which are not glaucous abaxially and do not bear leaf glands, distinguish that species from *M. arenicola*.

The distribution of *Mabea arenicola* is discontinuous, judged by the specimens known; it may be limited by the scattered distribution of white sand localities in Amazonia. It is at least partially sympatric with that of *M. speciosa* (e.g., in Colombia), but not of *M. subserrulata*.

The name of the species refers to the fact that up to now it is only known growing on white sands.

Paratypes. COLOMBIA. **Amazonas:** Río Igara–Parana, La Chorrera, menant au amont des rapides, 17 Sep. 1973 (fl), *C. Sastre 2241* (COL). VENEZUELA. **Territorio Federal Amazonas:** 8 km from San Carlos de Río Negro on road to Solano, 125 m, 19 Sep. 1975 (fl, imm. fr), *P. E. Berry 1428* (NY); Dep. Casiquiare, alrededores de Yavita (río Temi) y cerca de la carretera Yavita–Pimichín hasta el km 5 hacia Pimichín, 125–140 m, 6–19 July 1969 (fr), *G. S. Bunting et al. 3834* (U); road from San Fernando de Atabapo to Santa Barbara, 12–40 km from San Fernando, 110 m, 24 Mar. 1974 (fl), *A. Gentry & S. Tillett 10871* (HBG); IVIC Study Area, 4 km E of San Carlos de Río Negro, ca. 20 km S of confluence of Río Negro and Brazo Casiquiare, 120 m, 23 Nov. 1977 (fl, fr), *R. L. Liesner 3786* (DAV, MO), 4 Apr. 1979 (fl), *R. L. Liesner 6107* (DAV, MO); 2 km E of San Carlos de Río Negro, 120 m, 7 Apr. 1979 (imm. fr), *R. L. Liesner 6319* (DAV, MO), *R. L. Liesner 6358* (DAV, MO); 3–5 km NE of San Carlos de Río Negro, 120 m, 4 May 1979 (fr), *R. L. Liesner 7197* (DAV, MO); Yavita, 128 m, 2 Mar. 1942 (imm. fr), *Ll. Williams 14172* (F, G).

Mabea longibracteata Esser, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Río Negro, along Río Mawarinuma, E of Cerro de la Neblina expedition base camp, 0°50′N, 66°09′W, 140 m, 2 May 1984 (fl), *W. W. Thomas 3322* (holotype, DAV 104182). Figure 2.

Mabea similaris *M. speciosae* Mueller Argoviensis et *M. occidentali* Bentham sed laminis foliorum sparse et perduranter pubescentibus, axe inflorescentiae dense pi-loso, sepalis florum femineorum longitudinem duplicem ovariae adaequantibus saepe dimidio fissis, bracteis cymularum masculinarum 5–8 mm longis glandibus suis plus quam duplo longioribus.

Tree up to 12 m tall. Young twigs with dense, short pubescence. Leaf blades elliptic, (13–)17–25 cm long, 5.5–10.0 cm wide, apically acuminate (acumen at least twice as long as wide), basally obtuse to rounded, margin hardly serrate; secondary veins below the acumen in 17–23 pairs, distinctly brochidodromous; abaxially clearly and persistently but scattered pubescent, especially near midvein; glaucous only on intercostal fields, not on veins; 0–6 marginal glands on each half of blade, 0.1–0.3 mm diam., situated abaxially on the margin. Petioles (5–)7–10 mm long, pubescent. Stipules 20–25 mm long. Thyrses pale to greenish, not branched; staminate part 13–16 cm long, 3.5–5.0 cm wide, axis with dense indumentum of fairly long (up to 0.25(–0.4) mm), branched, sometimes also shortly papillate hairs. Bracts of staminate cymules 5–8 mm long, more than twice exceeding the bracteal glands, length of glands 2 mm, 0–1 mm removed from axis of thyrse; cymules three-flowered, pedicels 15–22 mm long, free; stamens ca. 40–60 per flower. Pistillate flowers 3–6; bracts glandless, rarely with glands similar to those of distal bracts; pedicel 14–23 mm, in fruit up to 24 mm long; sepals glandless, (3–)4–6 mm long, 2–3 mm wide, twice as long as ovary, often bifid apically; ovary brownish pubescent; style 15–25 mm long. Fruits 15–18 mm long, shape unknown. Seeds hardly carunculate, 10–12 mm long, 7.5–8.5 mm wide, 6–7 mm deep.

Mabea longibracteata is an endemic of the vicinity of Cerro de la Neblina. It grows in lowland rainforests on riverbanks and in swamps of clear and white water. Collected in flower May, December; in fruit July, December to February.

The type specimen of *Mabea longibracteata* has been distributed as *M. saramaccensis* Croizat.

Mabea longibracteata is most closely related to *M. occidentalis* Bentham and *M. speciosa* Mueller Argoviensis, both of which occur allopatrically in noninundated primary rainforests of large parts of South and Central America. It differs from both species in the larger bracts of the staminate cymules, which surmount their glands by more than 2 mm, and in its sepal and stipule lengths, which are longer than is the case with its relatives. Correlated with this, the sepals of the female flowers often are a little bifid. Another difference is the persistent but only scattered indumentum of the leaves, which makes this new species distinguishable even without flowers. *Mabea occidentalis* always has glabrous

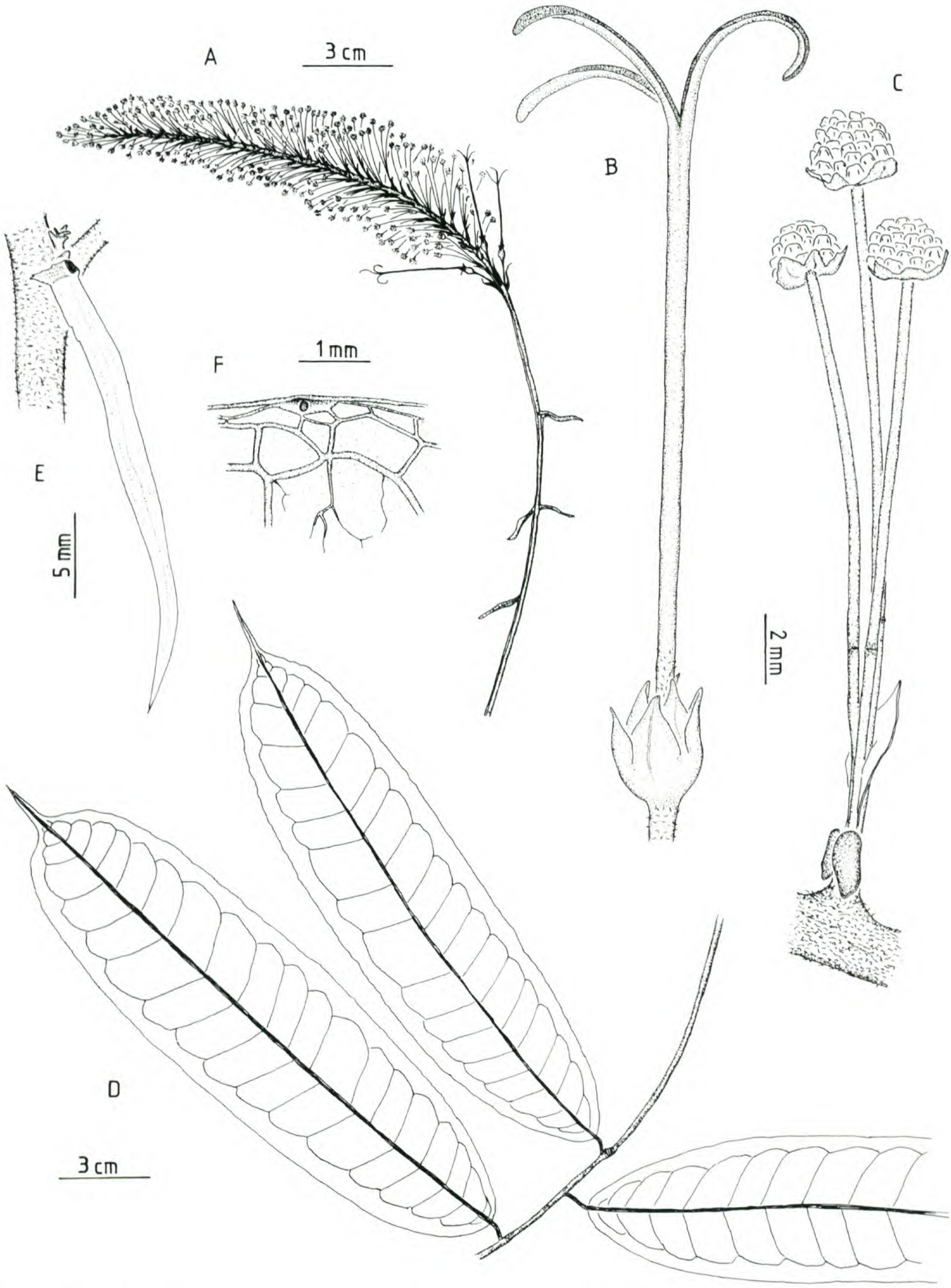

Figure 2. *Mabea longibracteata* Esser. —A. Inflorescence habit. —B. Pistillate flower. —C. Staminate cymule. —D. Leaves. —E. Stipule. —F. Portion of abaxial leaf margin showing glands. (A, D drawn from the type collection *Thomas 3322*; B, C, E, F from *Gentry & Stein 47219*.)

leaves, and *M. speciosa* bears a much denser pubescence if it is not completely glabrous.

Conspicuously long bracts, after which the species is named, are found only in species not closely related such as *Mabea klugii* Steyermark and *M. macrocalyx* Esser, which differ by much shorter styles and eucamptodromous leaf venation.

Paratypes. BRAZIL. **Amazonas:** Rios Negro, Cauaburí, Maturacá, Serra da Neblina, between Missão Salesiana and Serra Pirapucú, 800–1,000 m, 23 Jan. 1966 (fr), *N. T. Silva & U. Brazão NY 60861* (NY). VENEZUELA. **Territorio Federal Amazonas:** vicinity of Neblina Base Camp along Río Mawarinuma, along whitewater stream E of camp, 140 m, 4 Dec. 1984 (imm. fr), *T. B. Croat 59606* (HBG, MO); Depto. Río Negro, upper Río Baria, 66°17–22′W, 1°01–0°51′N, 100 m, 20 July 1984 (fr), *G. Davidse 27544* (HBG); swamp between Río Mawarinuma and headwaters of Río Baria, 66°15′W, 0°52′N, 140 m, 7 May 1984 (fl), *A. Gentry & B. Stein 47219* (HBG); Depto. Río Negro, along stream to 0–2 km E of Cerro de la Neblina Base Camp, which is on Río Mawarinuma, 140 m, 22 Feb. 1984 (fr), *R. L. Liesner 16181* (DAV, HBG); 1.5 km E of Cerro de la Neblina base camp, 0–3 km S of main river, 140 m, 2–3 Dec. 1984 (fl), *R. L. Liesner 17423* (HBG), 2–3 Dec. 1984 (imm. fr), *R. L. Liesner 17434* (HBG); Depto. Río Negro, along Río Baria (= Río Mawarinuma) just upstream from Base Camp, SW side of Cerro de la Neblina, 140 m, 16 Feb. 1985 (fr), *M. Nee 30884* (NY, U).

Mabea macrocalyx Esser, sp. nov. TYPE: Venezuela. Apure: Reserva Forestal San Camilo, al suroeste del caserío San Camilo (El Nula), a lo largo de la Quebrada La Azulita, 280 m, 30 Mar. 1968 (fl, fr), *J. A. Steyermark, G. Bunting & C. Blanco 101594* (holotype, NY; isotypes, DAV—2 sheets, NY, U, US). Figure 3.

Mabea laminis foliorum oblongo-ellipticis glabris non farinosis, sepalis florum femineorum magnis foliaceis pinnatinerviis partialiter pilosis glabrescentibus, fructibus 25–40 mm longis, cetera *M. klugii* Steyermark similis.

Tree up to 15 m. Young twigs with yellowish brown pubescence. Leaf blades elliptic to oblong, 13–21 cm long, 5.0–8.5 cm wide, apically acuminate (acumen less than twice as long as wide), basally obtuse to subcordate, hardly serrate; secondary veins below the acumen in 12–16(–19) pairs, eucamptodromous; glabrous; abaxially not glaucous; marginal glands 15–45 on each half of blade, 0.2–0.3(–0.5) mm diam., situated abaxially and not directly on the margin. Petioles 9–15 mm long, glabrous. Stipules ± 10 mm long. Thyrses not branched, staminate part 11–15 cm long, 3 cm diam., axis with dense indumentum of shortly papillate and longer (0.15–0.2 mm) branched hairs. Bracts of staminate cymules with mostly sessile and seldom basally elevated glands, length of glands 2 mm; cymules three-flowered, pedicels 12–14 mm long, free; stamens 25–40 per flower. Pistillate flowers 2–3; bracts with or without glands; pedicel 17–20 mm, in fruit up to 35 mm long; sepals leaflike, at anthesis 9–17 mm long, 3–8 mm wide, undivided, totally veiling the ovary, with conspicuous venation, pubescent only near base and on veins, glabrescent, sometimes with numerous minute marginal glands; ovary with lanate indumentum; style 10 mm, in fruit up to 22 mm long. Fruits 25–40 mm long, deeply sulcate, with lanate indumentum. Seeds 9–11 mm long, 6–9 mm wide, 7 mm deep, with large caruncle.

Mabea macrocalyx occurs in the Venezuelan part of the Andes, the Cordillera da Mérida. It grows in primary evergreen rainforests of 180–1,600 m altitude, often on sandy soils. Collected in flower February to April, June, July, September, October; in fruit February to May, July, September to November; sterile February.

Vernacular names: fruto de guacharaca, rabo de mula.

Mabea macrocalyx is easily recognized because of the large leaflike calyx lobes of its pistillate flowers and fruits. Remarkable are the size of these sepals, their conspicuous pinnate venation, their pubescence only near base and veins, and their glands, which resemble the marginal glands of leaf blades, but may be lacking. All these characters are unknown in any other species of *Mabea*. In most other morphological characters and in ecology it resembles *M. klugii* Steyermark and *M. elata* Steyermark. These two are probably the most closely related species and occur allopatrically: *M. klugii* from Costa Rica and Colombia southwards to Bolivia, *M. elata* in Ecuador and neighboring regions. Besides lacking the extraordinary sepals, they both differ by distinctly pubescent leaf blades with more conspicuous marginal serrulation and well-developed cuticular folds on their abaxial surfaces. The fruits of *M. klugii* are smaller (16–19 mm long) than those of *M. macrocalyx* and hardly sulcate; those of *M. elata* are unknown up to now. The bark of *M. macrocalyx* shows more conspicuous lenticels than observed in the other species.

Paratypes. VENEZUELA. **Apure:** Distr. Páez, Selva de Cutufí, between Cutufí on the Río Cutufí and the Río Sanare, 300–350 m, 8–12 Nov. 1982 (fr), *G. Davidse & A. C. González 21961* (MO); Reserva Forestal San Camilo, Cerro Nulita, a lo largo meridional del Río Nulita, 4½–5 km al N del caserío San Camilo (El Nula), oeste de la carretera, 280 m, 3 Apr. 1968 (fr), *J. A. Steyermark et al. 101770* (DAV, NY, U); Cerro Nulita, entre el Río Nulita y el caserío San Camilo (El Nula), 1.5 km al N de San Camilo, oeste de la carretera, en las filas y faldas

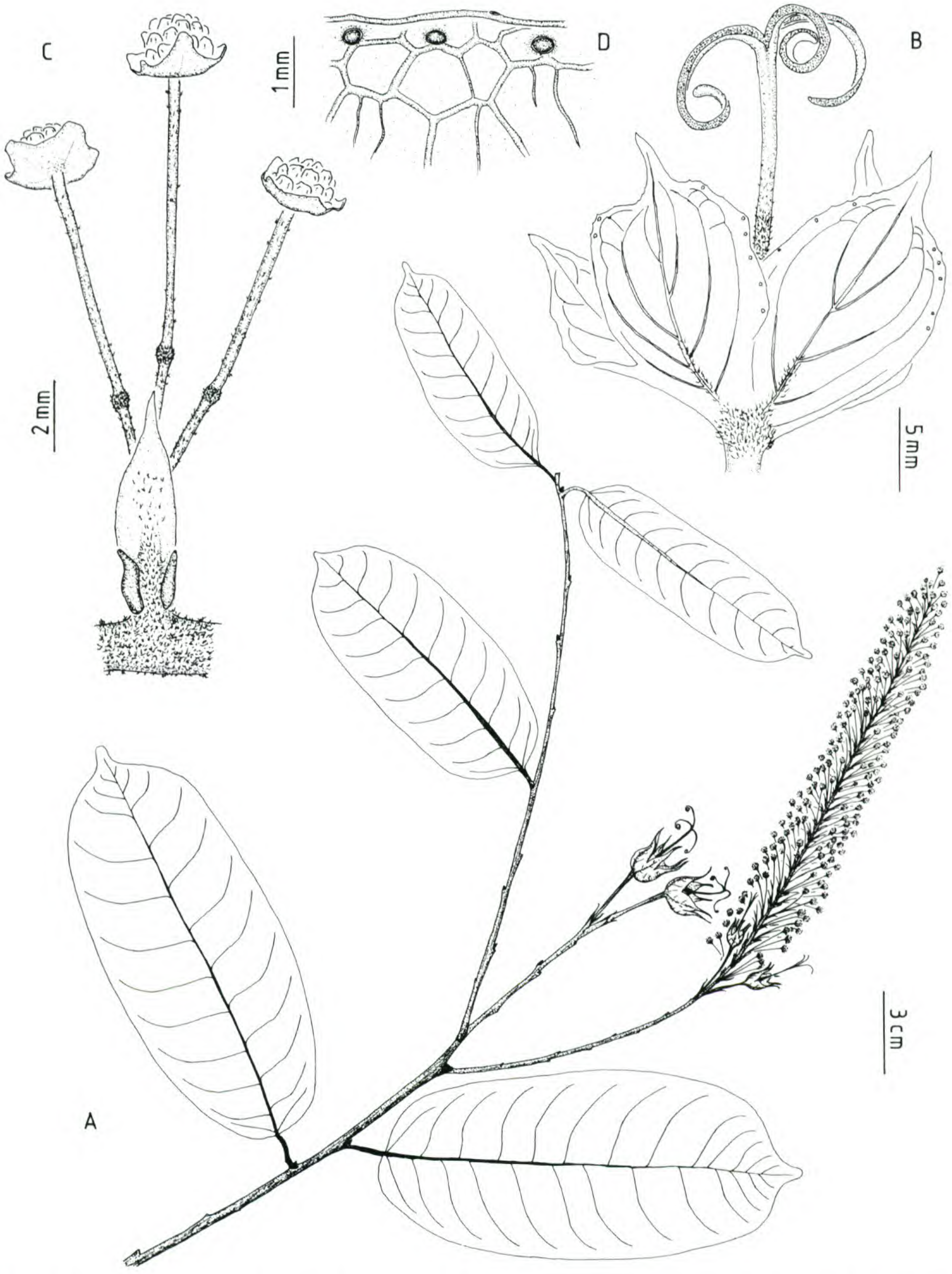

Figure 3. *Mabea macrocalyx* Esser. —A. Habit. —B. Pistillate flower. —C. Staminate cymule. —D. Portion of abaxial leaf margin showing glands. (All drawn from the type collection, *Steyermark et al. 101594.*)

pedregosas, 250–280 m, 4 Apr. 1968 (imm. fl), *J. A. Steyermark et al. 101856* (DAV, NY). **Barinas:** Altamira–Calderas, 850–1,600 m, 31 May 1957 (fr), *L. Bernardi 6857* (MER, NY—2 sheets); Distr. Pedraza, trail from Mesa de Canagua to Alto de La Aguada, ca. 23 km NW of Curbatí, 800–1,400 m, 17 Apr. 1988 (fl), *L. J. Dorr et al. 4764* (HBG); trail from Alto de La Aguada via Mesa de Canagua to El Algarrobo, 20 Apr. 1988 (fr), *L. J. Dorr et al. 4916* (HBG), 20 Apr. 1988 (fl), *L. J. Dorr et al. 4919* (HBG); Distr. Pedraza, trail from Mesa de Canagua to Cerro el Filón, W of the Río Curbatí, 600–880 m, 24 Nov. 1990 (fr), *L. J. Dorr et al. 7827* (HBG); Soledad, 20 km NO de Barinitas, 1,100 m, 28 Sep. 1953 (imm. fr), *E. L. Little, Jr. 15560* (MER); Distr. Bolívar, caserío La Soledad, a orillas de la carretera Mérida–Barinas, 1,600 m, 16 Feb. 1967 (imm. fr), *L. Marcano Berti 1517* (MER); La Soledad, 27 Sep. 1985 (fl), *L. Valverde 305* (MER); carretera rural Barinitas–Cacao, 3 Oct. 1989 (fl, imm. fr), *L. Valverde et al. 1177* (MER). **Lara:** Distr. Torres, Páramo Agua Linda, en la vecinidad de las torres de relevo de TV y en el Fundo Orion, arriba de la aldea Palmarito (en la carretera Lara–Zulia ca. 35 km al este de El Venado), en km 12–15 de la vía, 1,100–1,200 m, 6–7 Sep. 1980 (fl, fr), *G. S. Bunting & A. Stoddart 9733* (DAV, NY). **Mérida:** Palmarito–Aguas Calientes, Zea, 800–850 m, 4 Feb. 1954 (fl, fr), *L. Bernardi 1063* (MER, NY); Pueblos del Sur, Sta. Cruz del Quemado, 900 m, June 1955 (fl), *L. Bernardi 2231* (MER, NY—2 sheets); Distr. Alberto Adriani, Munic. El Vigía, 180–200 m, 23 July 1965 (fr), *S. López-Palacios 203* (MER); Palmarito, entre Zea y Los Giros, 16 July 1982 (fl, imm. fr), *L. Marcano Berti et al. 982-116* (MER); Distr. Tovar, Los Giros near El Osa, ± 5 km from previous location, 700 m, 26 July 1983 (imm. fr), *H. van der Werff & R. Ortíz 5710* (HBG, U). **Táchira:** between Rubio and La Muleta, 1,200 m, 15 Feb. 1939 (fl), *A. H. G. Alston 7063* (BM); Distr. Córdoba, Cerro El Mirador, Los Caracaro, 350–510 m, 8 Feb. 1980 (ster.), *E. Ara 42* (MER); on Río San Buena, 10 km W of La Fundación, around Represa Dorada, 700–1,000 m, 13–15 Mar. 1980 (fr), *R. L. Liesner et al. 9569* (DAV); 10 km E of La Fundación (13–23 km by road), around Represa Dorada, 600–1,000 m, 10–13 Mar. 1981 (fr), *R. L. Liesner & A. González 10429* (MO), 30 Apr. 1981 (fl, imm. fr), *R. L. Liesner & M. Guariglia 11608* (MO); Cerro Las Minas, bordering Quebrada Las Minas, 18–20 km SE of Santa Ana, 1,150–1,200 m, 29 July 1979 (fr), *J. A. Steyermark & R. L. Liesner 119033* (DAV, MO); alrededores de la Represa La Honda Campamento Siberia, Complejo Hidroeléctrico Uribante-Caparo, 19 Sep. 1988 (fl, fr), *L. Valverde & I. Peña 1068* (MER).

Mabea ovata Esser, sp. nov. TYPE: Brazil. Pará: Rio Jarí, Monte Dourado, Planalto A, 5 Oct. 1968 (fl), *N. T. Silva 1120* (holotype, IAN 127497; isotypes, NY—2 sheets). Figure 4.

Mabea laminis foliorum ovatis vel ellipticis integris parce pubescentibus, glandulis marginalibus numquam vero abaxialibus, thyrso 3.5–4 cm diametro, sepalis florum femineorum 6–9 mm longis saepissime divisis.

Tree 10 m tall. Young twigs sparsely pubescent, soon glabrescent. Leaf blades elliptic or ovate, (7–)9–18 cm long, (3–)4–8 cm wide, apically acuminate (acumen at least twice as long as wide), basally obtuse to cordate, entire; secondary veins below the acumen in 12–15 pairs, brochidodromous, sometimes indistinctly so; sparsely tomentose to glabrous; abaxially mostly without cuticular folds, rarely farinose; marginal glands absent or 3–20 on each half of blade, 0.1–0.15 mm diam., situated not abaxially but directed outwards. Petioles 7–11 mm long, sparsely tomentose to glabrous. Stipules not known. Thyrses with red flowers, not branched; staminate part 8–12 cm long, 3.5–4.0 cm diam., axis with dense pubescence of shortly papillate and dispersed longer (0.2–0.35 mm) hairs. Glands of bracts of staminate cymules not or only for less than half their own length removed from axis, length of glands (2–)3–3.5 mm; cymules three-flowered, pedicels 15–18 mm long, free; stamens at least 50 per flower. Pistillate flowers 3–4; bracts glandless or with glands similar to those of distal bracts; pedicel 9–13 mm long; sepals 6–9 mm long, 2–4 mm wide, much longer than ovary, often bifid and therefore seemingly more than 6, glandless or rarely basally glandulous; ovary without brown indumentum; style 7–10 mm long. Fruits and seeds not known.

Mabea ovata is a species of terra-firme primary forests, known only from one locality in northeastern Amazonia. Collected in flower March, August, and October.

Vernacular name: taquarirana.

Mabea ovata is characterized by the sepals of pistillate flowers and some characters of the leaves. The sepals are unusually long and comparatively narrow and, in contrast to many other species, very often divided their entire length so that they simulate a larger number than six. They are only comparable to those of *M. elegans* Rusby (= *M. prancei* Emmerich, syn. nov.) and *M. uleana* Pax & K. Hoffmann, both of which grow on riverbanks and white sand areas of central Amazonia. These two species differ especially by their much narrower thyrses (diameter less than 2 cm) and characters of their leaves.

The leaves of *Mabea ovata* can be recognized by their shape, which may be elliptic but often is a little ovate, a shape quite unusual within *Mabea*. Therefore, the species is named for this character. Moreover, the leaf margins are unusual. Not only are the margins entire but the marginal glands are not abaxial ones as they are in nearly all other species. They are placed totally on the marginal sclerenchyma, if they are present at all. The secondary venation of *M. ovata* is more or less brochidodromous, sometimes intermediary to eucamp-

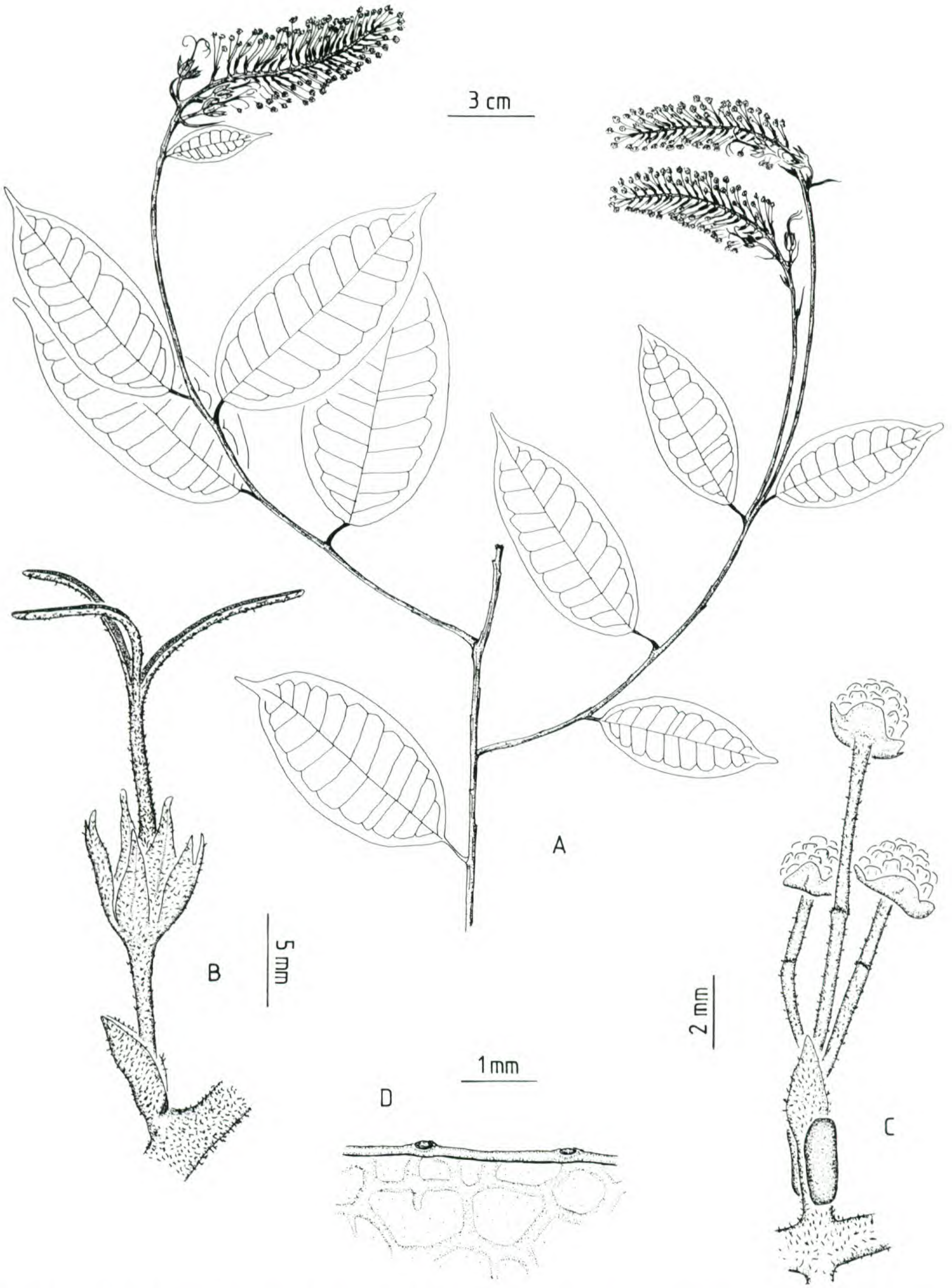

Figure 4. *Mabea ovata* Esser. —A. Habit. —B. Pistillate flower. —C. Staminate cymule. —D. Portion of abaxial leaf margin showing glands. (A–C drawn from *Kubitzki 87-4;* D from the type collection, *Silva 1120.*)

todromous; in other *Mabea* the two character states are clearly separate.

Paratypes. BRAZIL. **Pará:** Monte Dourado, Waldrand der Reserva "Agua azul," 27 Mar. 1987 (fl), *K. Kubitzki 87-4* (HBG); Rio Jarí, Planalto de Monte Dourado, 27 Aug. 1968 (fl), *E. de Oliveira 4799* (NY).

Mabea salicoides Esser, sp. nov. TYPE: Brazil. Amazonas: Estrada Manaus–Itacoatiara km 133, 11 July 1974 (fl), *W. Rodrigues & A. Loureiro 9489* (holotype, RB 222095; wood specimen, INPA Xil 5875 not seen). Figure 5.

Mabea laminis foliorum 11–17 cm longis 5 cm latis integris parce farinosis nervatura quasi brochidodroma glandulis paucis fere latrorsis, thyrso usque ad 8 mm diametro tripliciter ramoso ovariis ferruginee pubescentibus et glandulis bractearum cymularum mascularum sessilibus, numero staminum uniuscujusque floris 15 non superante, cetera *M. piriri* Aublet affinis.

Tree, 10 m tall, 18 cm DBH. Young twigs shortly tomentose, otherwise glabrous. Leaf blades elliptic, 11–17 cm long, 5 cm wide, apically acuminate (acumen one to two times as long as wide), basally acute to obtuse, margin entire; secondary veins below the acumen in (7–)9–11 pairs, brochidodromous; adaxially nearly glabrous, abaxially shortly tomentose, rarely totally glabrescent; cuticular folds indistinct to absent; marginal glands 0–3 on each half of blade, up to 0.3 mm diam., situated on marginal sclerenchyma. Petioles 10–12 mm long, glabrous. Stipules not known. Thyrses yellowish, compound with at least three orders of branches; staminate part 4 cm long, 6–8 mm diam., axis with distinct indumentum of hardly branched, 0.1–0.15-mm-long hairs. Glands of bracts of staminate cymules touching the inflorescence axis, length of glands 0.5–1.0 mm; cymules three-flowered, pedicels 1.5–3 mm long, free; (2–)5–15 stamens per flower. Pistillate flowers 0–2; bracts glandless; pedicel 5–9 mm, in fruit up to 25 mm long; sepals glandless, up to 2 mm long, not extending beyond ovary, not divided; ovary brownish pubescent; style 4 mm long. Fruits 15–16 mm long, shape unknown. Seeds 10 mm long, 9 mm wide, 8 mm deep, without caruncle.

This species grows in terra-firme high forest near Manaus in central Amazonia, locally frequent, on soils with fine texture. Collected in flower July, September.

Vernacular name: taquari.

Mabea piriri Aublet (= *M. maynensis* Mueller Argoviensis) exhibits a considerable amount of variation in the diameter of the inflorescences, ranging from 2 to 4 cm. This new taxon, with a diameter of 6–8 mm, however, cannot be included within the concept of *M. piriri.* Furthermore, the bracteal glands of *M. salicoides* touch the axis on the entire length of the staminate part of the thyrse, a character state not observed in *M. piriri.* Correlated with the minute thyrses is the small number of stamens per flower, but this is a fallible character for *Mabea* at the species level. Characters of fruits and leaves do not differ significantly from those of *M. piriri*, although the pubescence, the wide loops of the secondary veins, i.e., the large distance of the consecutive secondary veins and the small number of them, would be unusual for *M. piriri.*

The other species of *Mabea* with very small thyrses (e.g., *M. pohliana* (Bentham) Mueller Argoviensis) exhibit leaves with clearly different indumentum, marginal glands and in most cases, moreover, with eucamptodromous, not brochidodromous, secondary leaf venation.

The thyrses of this new species are reminiscent of catkins of genera like *Salix* L.; it is named for this resemblance.

Surprisingly, a plant collected in French Guiana resembles the cited specimens quite closely: GUYANE FRANÇAISE: Saül, Monts La Fumée Oeste, 53°12′W, 3°37′N, alt. 200–400 m, 30 Oct. 1982 (fl), *S. Mori & Boom 15146* (HBG); same tree, 9 Apr. 1983 (fr), *S. Mori & J. Pipoly 15556* (HBG). This tree differs from the ones from Brazil in greater height (20 m), abaxially clearly farinose leaves with 12–13 secondary veins and 10–18 abaxial glands on each half, and in thyrses with completely glandless bracts. Therefore, it only partially agrees with the diagnosis given for *M. salicoides.* In characters of pubescence, fruits, pistillate and staminate flowers it covers this species very well. Untypically glandless bracts are known from, e.g., *M. taquari* Aublet; the other mentioned differences do not seem to justify separation. The two specimens, therefore, represent *M. salicoides.*

Paratypes. BRAZIL. **Amazonas:** Estrada Manaus–Itacoatiara, km 106, 14 Sep. 1965 (fl, imm. fr), *W. Rodrigues & A. Loureiro 7161* (INPA); BR-174, km 64, depois 27 km leste no ZF-3 na Fazenda Esteio, Reserva 1301 do Projeto Dinamica Biologica de Fragmentos Florestais, 8 Jan. 1986 (fr), *D. D. Ackerly 121* (NY).

Mabea fistulifera C. Martius subsp. **bahiensis** (Emmerich) Esser, stat. nov. Basionym: *Mabea bahiensis* Emmerich, Bradea 5: 289. 1989. fig. 2. TYPE: Brazil. Bahia: Espigão Mestre, 34 km W of Barreiras, 710 m, 2 Mar. 1972 (fl), *W. R. Anderson, M. Stieber & J. H. Kirkbride, Jr. NY 36449* (holotype, R not seen; isotypes, AAU, NY, US).

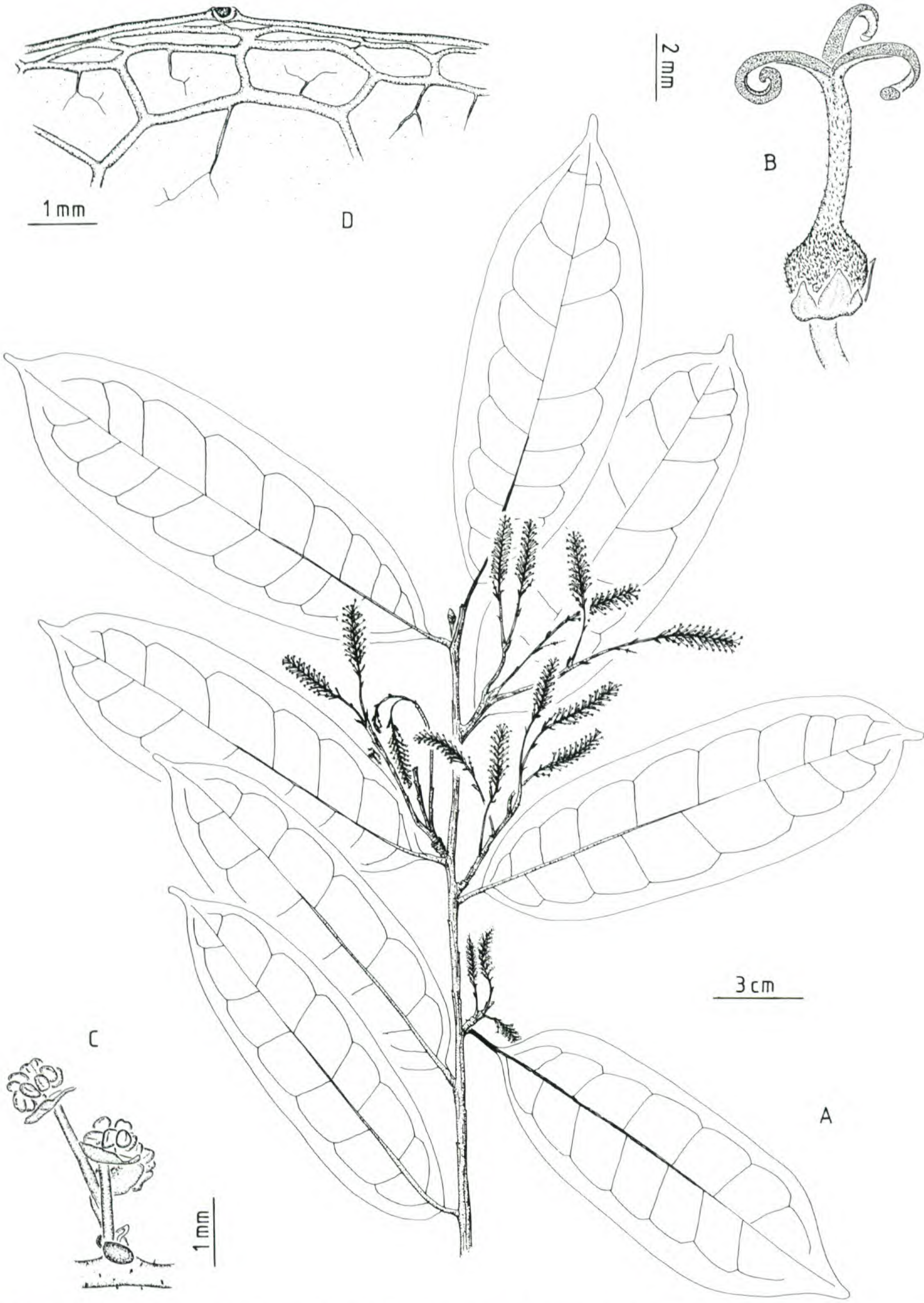

Figure 5. *Mabea salicoides* Esser. —A. Habit. —B. Pistillate flower. —C. Staminate cymule. —D. Portion of abaxial leaf margin showing glands. (A, D drawn from the type collection *Rodrigues & Loureiro 9489;* B, C from *Rodrigues & Loureiro 7161.*)

This taxon should not be accepted as a separate species. It is distributed allopatrically to the typical *Mabea fistulifera* and differs only by the indumentum on the entire abaxial leaf surface and by the nearly crenate, hardly serrate margin of the blades with somewhat larger space between the teeth. Reproductive characters do not differ in any significant way. Because the indumentum of *M. fistulifera* occurs constantly and characteristically only on the median part of the leaf blades, these differing plants should be admitted as separate on the subspecific level.

Additional specimens examined. BRAZIL. **Bahia:** Espigão Mestre, ca. 100 km WSW of Barreiras, 750–800 m, 8 Mar. 1972 (fl), *W. R. Anderson et al. NY 36830* (F, NY); valley of the Rio das Ondas, slopes of Espigão Mestre, ca. 25 km W of Barreiras, 600 m, 3 Mar. 1971 (fl), *H. S. Irwin et al. NY 31359* (AAU, DAV, K, NY); Mun. Barreiras, estrada Belém–Brasília, BR 020, 40 km de Barreiras, 45°17′W, 12°05′S, 26 Mar. 1984 (fl), *M. L. Moreira & E. F. Almeida 11* (RB); São Desidério, margem da BR 020, prox. à divisa Bahia–Goiás, 20 Mar. 1981 (fl), *G. C. P. Pinto 237/81* (RB); Mun. Barreiras, 45°09′W, 12°07′S, 1,140 m, 22 May 1984 (fl), *S. B. da Silva & R. A. Viegas 354* (RB).

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Notes on *Clitoria* (Leguminosae) in Southeast Asia

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ABSTRACT. New infraspecific taxa of two species of *Clitoria* subg. *Neurocarpum* sect. *Tanystyloba* (Leguminosae) from Southeast Asia are described. New taxa include: *Clitoria hanceana* var. *latifolia* (Thailand), variety *petiolata* (Cambodia), and variety *thailandica* (Thailand); and *Clitoria macrophylla* var. *sericea* (Thailand) and variety *stipulacea* (Thailand). *Clitoria hanceana* var. *hanceana* (China) and *C. macrophylla* var. *macrophylla* (Burma, Vietnam) are circumscribed. The circumscription of *Clitoria hanceana* var. *laureola* (Vietnam) is emended with the exclusion of two of the four syntypes.

The Botanical Survey of India is sponsoring a taxonomic treatment of the genus *Clitoria* (Leguminosae) that will include Indian and closely related taxa of Southeast Asia from Pakistan to China to Malaysia. The treatment of two species, *C. hanceana* Hemsley and *C. macrophylla* Wallich ex Bentham, presents taxonomic problems. Aubréville & Leroy (1979) published a treatment of *Clitoria* for the Flora of Cambodia, Laos, and Vietnam in which they recognized two varieties of *C. hanceana* and no varieties for *C. macrophylla*. They cited very few herbarium collections, as herbarium vouchers of *Clitoria* from Southeast Asia are limited in major collections. Both *C. hanceana* and *C. macrophylla* have broad ranges of distribution with morphological variance that appears geographically segregated. Examination of specimens from a broader geographical area indicates that more varieties are involved. Field studies are needed on both of these species.

Fantz (1979) assigned both species to subgenus *Neurocarpum* (Desvaux) Baker sect. *Tanystyloba* Fantz. The objectives of this paper are to validate the new taxa and to provide lectotypification for those taxa for which the original author did not designate a holotype. Additional vouchers will be cited in my article to be published in the *Bulletin of the Botanical Survey of India*.

Typification for some names involves duplicate specimens deposited in different herbaria of the only collection cited by the original author. Some taxonomists argue that since the original author cited only one collection, one must currently designate one of these known specimens as a holotype and the others as isotypes. Other taxonomists argue that with two or more specimens available (syntypes), any designation of one specimen to serve as a nomenclatural type by a current author must be designated as a lectotype, not a holotype. Article 7.3 of the Code (Greuter et al., 1988) states "A holotype is the one specimen or illustration used by the author or designated by him as the nomenclatural type." Because the original author did not designate one specimen as the type, the present author must conclude from evidence available which of these specimens will best serve as the nomenclatural type. The treatment here follows the latter interpretation, and the specimen selected is designated as "lectotype" in accordance with Article 7.5 of the Code (Greuter et al., 1988), and duplicates are designated as isolectotypes.

CLITORIA HANCEANA

Clitoria hanceana Hemsley, J. Linn. Soc. 23: 187. 1887. TYPE: [China. Gwangdong:] In incultis secus amnem "North River," circ. 200 millipas, a Cantone, 23 July 1864, *Sampson 11364* (lectotype, selected here, K-hb. Hance; isolectotype, BM).

Aubréville & Leroy (1979) incorrectly cited *Hance 11364* as the type and treated the specimen at BM as the holotype and the one at K as the isotype. This species was originally reported by Hance (1878) as *C. macrophylla* Wallich, a misidentification. Hance cited one collection, *Sampson 11364*, but did not indicate the location of this collection. Hemsley (1887) recognized its distinction from *C. macrophylla* and described the new species, named in honor of Hance, citing the specimens in Hance's herbarium at BM and K. Hemsley (1887) described the petals, including the clawed wings and keel, and the ovary. Vouchers of *Clitoria* commonly have their large flowers glued to the herbarium sheet, thus the wings and keels, and especially the ovary, are obscured from observation, as in the specimen at BM. The specimen at K contains a dissected flower in its packet, thus it more closely matches

the original description by Hemsley. The specimen at K should be treated as the nomenclatural type because it is the main specimen upon which Hemsley apparently based his description. Five varieties are recognized.

1. Clitoria hanceana var. **hanceana.**

Stem internodes 2–4 cm long, strongly flexuous. Leaves trifoliolate, subsessile, leaflets narrow, 5–9 cm long, 2–3.5 cm wide, lower surface sericeous. Petiole 0.3–1 cm long, shorter than 1–2-cm-long rachis. Stipules 5–8 mm long. Inflorescence of lax pseudoracemes, 1–3 per axil; peduncles 5–15 mm long. Calyx tube 8–10 mm long.

Variety *hanceana* is recognized by its subsessile leaves borne from strongly flexuous branches with narrow leaflets, sericeous below, and shortened leaf rachis. This variety is endemic to China.

2. Clitoria hanceana var. **laureola** Gagnepain in Lecomte, Fl. Indochine 2: 313. 1916. TYPE: Cochinchina. *Pierre s.n.* (lectotype, designated by Aubréville & Leroy (1979), P not seen).

Stem internodes 1.5–4 cm, flexuous. Trifoliolate leaves subsessile, leaflets narrow, 4–9 cm long, 1.5–3(–3.5) cm wide, lower surface sericeous. Petiole shorter than rachis, 0.3–1.3 cm long; rachis 1–1.8(–2.3) cm. Stipules 4–7 mm. Inflorescences 3–8 per axil, fascicled in axillary glomerules up to 1 cm diam., highly bracteated; inflorescence axis 5–7 mm long, peduncles 2–4 mm long with rachis internodes of 1–2 mm; flowers crowded, numerous. Calyx tube short, 5–7(–8) mm long.

Gagnepain (1916) cited four collections of this variety. Collections by Pierre and Thorel bear the name *Clitoria laureola* on the herbarium voucher. There are several unnumbered Pierre collections from Cochinchina. All of those I examined bear glomerate inflorescences. The Godefroy collection lacked the name *C. laureola*, and the Massie collection has not been located. Gagnepain distinguished the variety by the glomerulate inflorescences and vegetative features, such as longer bracteoles, longer petioles, and somewhat narrower, lanceolate leaflets. His diagnostic characters either break down or do not agree with all of the cited collections. Only the first characteristic described (glomerate inflorescences) was not variable; only the Pierre collections bear this characteristic. Aubréville & LeRoy (1979) designated a collection at P as the lectotype. Two specimens (F 540296, K) of *Pierre s.n.* (Cochinchine, ad Chóben prope Baria, Oct. 1866) were examined, and these may be isolectotypes. Specimens with nonglomerate inflorescences, including the Thorel and Godefroy collections, are excluded in the emended circumscription of this variety known only from Vietnam, not all of Cochinchina.

3. Clitoria hanceana var. **latifolia** Fantz, var. nov. TYPE: Thailand. Central: Petchaburi prov., June 1868, *Pierre 72* (holotype, E; isotype, K).

Varietas nova *Clitoria hanceana* optime distinguitur foliis latis trifoliolis et rhachibus elongatis.

Stem internodes elongated, 4–9 cm long, weakly flexuous. Leaves trifoliolate, subsessile, leaflets broad, 6–14 cm long, 4–8 cm wide, moderately sericeous below. Petiole shorter than rachis, 0.3–0.9 cm long; rachis (2–)2.5–3.7 cm long. Stipules 6–8 mm long. Inflorescence of lax racemes, 1–3 per axil. Calyx tube 8–9 mm long.

This variety is distinguished by its broad leaflets. The specimen at E has flowers and younger leaves, whereas the specimen at K lacks flowers but bears more mature leaves. The variety is endemic to Thailand.

4. Clitoria hanceana var. **petiolata** Fantz, var. nov. TYPE: Cambodia. Strung-streng, Me Kong Exp., 1866–68, *Thorel s.n.* (holotype, BM; isotypes, E, F 540762).

Varietas nova *Clitoria hanceana* optime distinguitur foliis petiolatis elongatis.

Stem internodes elongated, 3–10 cm, weakly to strongly flexuous. Trifoliolate leaves short-petiolate; leaflets narrow, 5–10 cm long, 2–4 cm wide, lower surface with pubescence thinly sericeous to strigose. Petiole subequal to longer than the rachis, 1.5–4 cm long; rachis 1–2.3 cm. Stipules (5–6–)8–10 mm. Inflorescence of lax racemes, nonglomerulate, 1–2 per axil; peduncles 3–5 mm.

Aubréville & Thorel (1979) included the type within variety *laureola* Gagnepain, from which it has been excluded in this treatment. Variety *petiolata* is distinct from variety *laureola* by the geographical isolation accompanied by the morphological characteristics of petiolate leaves with the petiole longer than the rachis, larger stipules, and lax racemes. This is the only variety of *C. hanceana* with leaves bearing an elongated petiole that is longer than the rachis.

This variety is endemic to Cambodia, a country that lacks any known collections of other varieties of *C. hanceana*.

5. Clitoria hanceana var. **thailandica,** var. nov. TYPE: Thailand. Northeast: Ban Chut Seng, Koret, 21 Mar. 1930, *Put 3074* (holotype, K; isotype, BM).

Varietas nova *Clitoria hanceana* optime distinguitur foliis brevipetiolatis et subter spisse pubescentibus et stipulis elongatis.

Stem internodes elongated, 3–9 cm, weakly flexuous. Trifoliolate leaves short-petiolate, leaflets narrow, 7–11 cm long, 2–4 cm wide, lower surface densely sericeous. Petiole shorter than the rachis, 0.5–2 cm long; rachis 1.5–2.5 cm long. Stipules 7–11 mm long. Inflorescences loose racemes, 1–2 per axil; peduncles 0.5–1.5 cm. Calyx tube 7–9 mm long.

Specimens of this taxon were annotated as variety *thailanensis* Fantz. Reviewers noted that "thailanensis" is an incorrect Latinization of Thailand, thus the epithet was corrected to follow recommendations.

This is most common variety occurring in Thailand, recognized easily by its short-petiolate leaves, elongated stipules, and the leaflets being narrow and densely sericeous below.

CLITORIA MACROPHYLLA

Clitoria macrophylla Wallich ex Bentham, Miquel Pl. Jungh. 2: 232. 1852. *Clitoria macrophylla* Wallich, Cat. no. 5345. 1831–1832. nomen nudum; not Hance (1878). TYPE: Burma. Pegu: Mount Prome, *Wallich Hb. 5345* (lectotype, selected here, K-Hb. Bentham; isolectotype, BM).

Wallich (1831) published this species without a description, citing it as number 5345. Bentham (1852) validated the name and cited "*C. macrophylla* Wall. Cat. n. 5345." Locality data were provided as "In montibus *Prome* et *Tavoy* (Wallich)." Two specimens of *Wallich 5345* are known (BM, K); a third specimen (Prome or Paong pong, *Wallich 5345B*) was filed within the type folder at K along with *Wallich 5345;* a fourth specimen, "Tavoy, *Wallich 5345H,*" is at BM. Bentham may or may not have studied all four specimens, although inclusion of all locality data (Mount Prome and Tavoy) imply that he probably did. Of the four possible syntype specimens known, the latter pair were eliminated as choices for the nomenclatural type because neither Wallich nor Bentham cited the letters. The specimen of *Wallich 5345* in Bentham's herbarium was selected as the lectotype because it was the more probable one Bentham studied and used for his description. The letters and different locality data indicate that specimens "B" and "H" were different collections made of the same taxon as number "5345," not duplicates of it. Therefore, *Wallich 5345B* and *5345H* are not recognized as isolectotypes.

1. Clitoria macrophylla var. **macrophylla.**

Suffrutescent herb with erect to lax stems, apex trailing to climbing, weakly twining. Leaves trifoliolate, leaflets 1.5–2.5 times longer than wide, 4.5–14 cm long, 2.5–6 cm wide, ovate, elliptic-ovate or occasionally lanceolate-elliptic, sparsely pubescent below with trichomes subappressed, scattered, primary nerves of 9–12(–15) pairs. Stipules 5–9 mm long, 2–4 mm wide. Petioles (4–)5–10 cm long. Calyx lobes 10–13 mm long. Legumes uncinate pubescent as juvenile becoming glabrate with scattered remnants as it matures.

Variety *macrophylla* is recognized by its broader leaflets with scattered, appressed trichomes below, elongate petioles, shorter calyx lobes, and glabrate fruits. Phenology is poorly noted by collectors, as dates are lacking or reported only by year. Flowering and fruiting are reported to occur in mid-July to late August. This variety has been collected in India (1836–1838) several times by Helfer, but does not appear to occur there presently. It is commonly collected in Burma, and two collections are known from Vietnam.

2. Clitoria macrophylla var. **sericea** Fantz, var. nov. TYPE: Thailand. [Central Province]: Hua Wai, Nakawn Sawan, 30 Aug. 1931, *Put 4085* (holotype, K; isotype, BM).

Varietas novas *Clitoria macrophylla* optime distinguitur foliis trifoliolatis, brevipetiolatis et subter sericeis, foliolis elongatis, brevistipulis et brevistipellis. Thailanensis.

Suffrutescent herb, stems trailing to climbing. Leaves trifoliolate, leaflets elongated, 2–4 times longer than wide, (5–)6–15 cm long, 2–6 cm wide, oblong or lanceolate, elliptic-oblong, oblong-lanceolate to oblanceolate-oblong, moderate to densely sericeous below, primary lateral veins of 12–18 pairs. Stipules 7–11 mm long, 2–4 mm wide; stipels 5–8 mm long. Petioles 2–6.5 cm long. Calyx lobes 11–15 mm long. Legume uncinate pubescent, rarely glabrate. The holotype has the best display of flowering and fruiting material, one of which is typically lacking in other vouchers. However, the leaves are more immature; the leaflets are characteristically sericeous, but not as elongated as in other specimens,

although oblong in shape; stems are less flexuous than in several specimens, but similar in bearing shorter internodes and petioles than the typical variety; fruits are somewhat immature being flatter, turgid only around the seeds, but conspicuously uncinate pubescent when viewed at higher magnifications. *Put 1850* was selected as a paratype because it has turgid mature fruits, more flexuous stems, and more mature elongated leaves that become broader. *Marcan 2419* was added as a paratype because it was collected the same day from the same locality as *Put 1850*. The type and paratypes provide a typical range of characters for this variety, commonly collected with flowers and fruits in July and August, rarely with only fruit in November–December. This endemic to Thailand is distributed in the North, Northeast, and Central Provinces.

Paratypes. THAILAND. [**Central Province**]: Sai Yok, Kanburi, 3 Aug. 1928, *Put 1850* (BM, K); Sai Yok, Kanburi, 300 m, 3 Aug. 1928, *Marcan 2419* (K).

3. Clitoria macrophylla var. **stipulacea** Fantz, var. nov. TYPE: Thailand. [North Providence]: Lampoon, Me Lee, 1,200 ft., 7 Aug. 1915, *Winit 360* (holotype, E; isotype, K).

Varietas novas *Clitoria macrophylla* optime distinguitur foliis trifoliolis et/vel unifoliolis, brevipetiolatis et subter sericeis, foliolis, elongatis, longistipulis et longistipellis.

Subshrub to suffrutescent herb, stems scrambling. Leaves trifoliolate and unifoliolate, leaflets 1.5–3 times longer than wide, 5–16.5 cm long, 3–6.5 cm wide, elliptic-oblong to oblong-lanceolate, primary lateral veins of 12–16 pairs, sericeous below. Stipules (9–)13–18 mm long, 4–5 mm broad, stipels 7–16 mm long. Petioles 2–5 cm long on trifoliate leaves, 4–9 cm long on unifoliate leaves; rachis 2–4 cm long. Calyx lobes 12–15 mm long. Legume uncinate pubescent.

This variety is distinguished by the prescence of unifoliolate leaves and the elongated, conspicuous stipules and stipels. It is infrequently collected from late May to early July. Endemic to the the North Province of Thailand, collected from the "papeh" and deciduous dipterocarp jungle/forests.

Paratypes. THAILAND. [**North Providence**]: Doi Pha Dam between Hang Dang and Bo Luang, 18°17′N, 98°30′E, 600 m, 5 July 1968, *Larsen et al. 2123* (E, K).

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Aragoa corrugatifolia (Scrophulariaceae), una Nueva Especie de los Páramos de Colombia

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RESUMEN. Se describe una nueva especie de *Aragoa* (Scrophulariaceae) de la Cordillera Oriental de Colombia. Se comenta su relación con otras especies del grupo "abietina," al cual se adscribe.

ABSTRACT. A new species of the genus *Aragoa* (Scrophulariaceae) from the Colombian Cordillera Oriental is described, and its relationships with other species of the "abietina" group, in which it is included, are discussed.

Durante la revisión aún en curso del género *Aragoa*, se detectó una especie no descrita, endémica de los páramos más meridionales de los departamentos de Cundinamarca y Meta. Esta nueva especie había sido identificada como *A. abietina* HBK, (Cleef, 1979; Baumann, 1988), con la que sin duda guarda cierta relación.

Con respecto al carácter de la sección transversal de la hoja en su zona media, que aquí se utiliza, se hace la aclaración de que dicha sección se ha realizado tanto en hojas jóvenes (de las ramas apicales) como en maduras (de la zona media del eje principal). Siempre se ha partido de hojas secas de los pliegos de herbario, y el corte se ha efectuado con bisturí, apoyando la hoja en una superficie semiblanda. Este tipo de corte permite de forma rápida—sin entrar a considerar caracteres de vascularización ni anatómicos—obtener información comparable o contrastable sobre la forma de la sección, el grosor y la consistencia de hojas jóvenes y adultas de las diferentes especies.

Aragoa corrugatifolia Fernández Alonso, sp. nov. TIPO: Colombia. Cundinamarca: Distrito Especial de Bogotá, sur de Bogotá, orilla del río Tinjuelito, 27 sep. 1952 (fl, fr), *Fernández Perez, A. & R. Jaramillo M. 1506* (holótipo, COL–84797; isótipo, US–2844824). Figuras 1d–g, k–o y 2b.

A proxima *A. abietina* ramis tertiariis carentibus, ramis ramulisque juvenilibus subglabris, foliis minoribus, 4.5–5.6 × 0.6–0.9 mm; foliis axialibus maturis tantum subcoriaceis, dimidio basali subtus irregulariter atque transverse plicatis, sectione transversali supra conspicue convexis et subtus concavis; sepalis brevioribus, 4.5–5(–6) mm longis differt.

Arbusto de 100–220 cm de altura, por lo general ramoso en las partes superiores. Tallo inferior de hasta 3–4 cm de diámetro, de 1–1.3 cm en la parte superior (ca. 35 cm del apice). Ramas primarias del eje principal verticiladas, largas, con escasa proliferación de ramas secundarias, ascendentes, que parten del eje con un ángulo de 45–60(70)° (Fig. 2b). Corteza del eje principal y de la zona inferior de las ramas, estriada longitudinalmente, con vestigios de hojas viejas degradadas. Ramas jóvenes terminales, glabras o subglabras, de 2–2.5 mm de diámetro (sin hojas) y 7–10 mm con la columna foliar. Hojas decurrentes en ⅕ de su longitud, disposición en las ramas arqueado-recurvadas, no claramente adpresas. Hojas jóvenes (de las ramas superiores), de (4.5)5–5.6 × 0.6–0.9 mm, lámina linear-lanceolada, subcoriácea, con brillo, de sección convexo-plana (haz- envés) o ligeramente convexo-cóncava, marcadamente aquillada en el dorso (envés), aguda en el ápice, con abundantes puntuaciones glandulares en el haz y escasas en el envés (Fig. 1d–g). Hojas maduras del eje principal, adosado-adpresas al tallo, dispuestas en 8 filas o series ascendentes, de (6)6.5–7.5(8) × 0.6–1.2 (1.4) mm, linear-lanceoladas o las menos estrechamente lanceoladas, ligeramente adelgazadas cerca de la zona de unión al tallo, lámina en la mitad inferior, transversalmente estriado-corrugada, pliegues irregulares; sección marcadamente convexo-cóncava (haz-envés), costilla central del envés muy pronunciada y aguda, márgenes foliares totalmente arqueado-recurvados (Fig. 1k–o). Flores dispuestas de forma ± densa en las ramas jóvenes, solitarias o geminadas en la axila de una bráctea foliácea (cada bráctea floral, recubre a 2 bractéolas, generalmente con una flor cada una), bractéola de 2–3 mm de longitud, estrechamente triangular, completamente concava, amplexicaule, que recubre al pedicelo y parte del cáliz; ocasionalmente flores aparentemente verticilladas, por la presencia de varias brácteas fértiles ± al mismo nivel. Pedicelo floral menor o igual a 1 mm en flor y de hasta 1.9 mm en el fruto. Cáliz

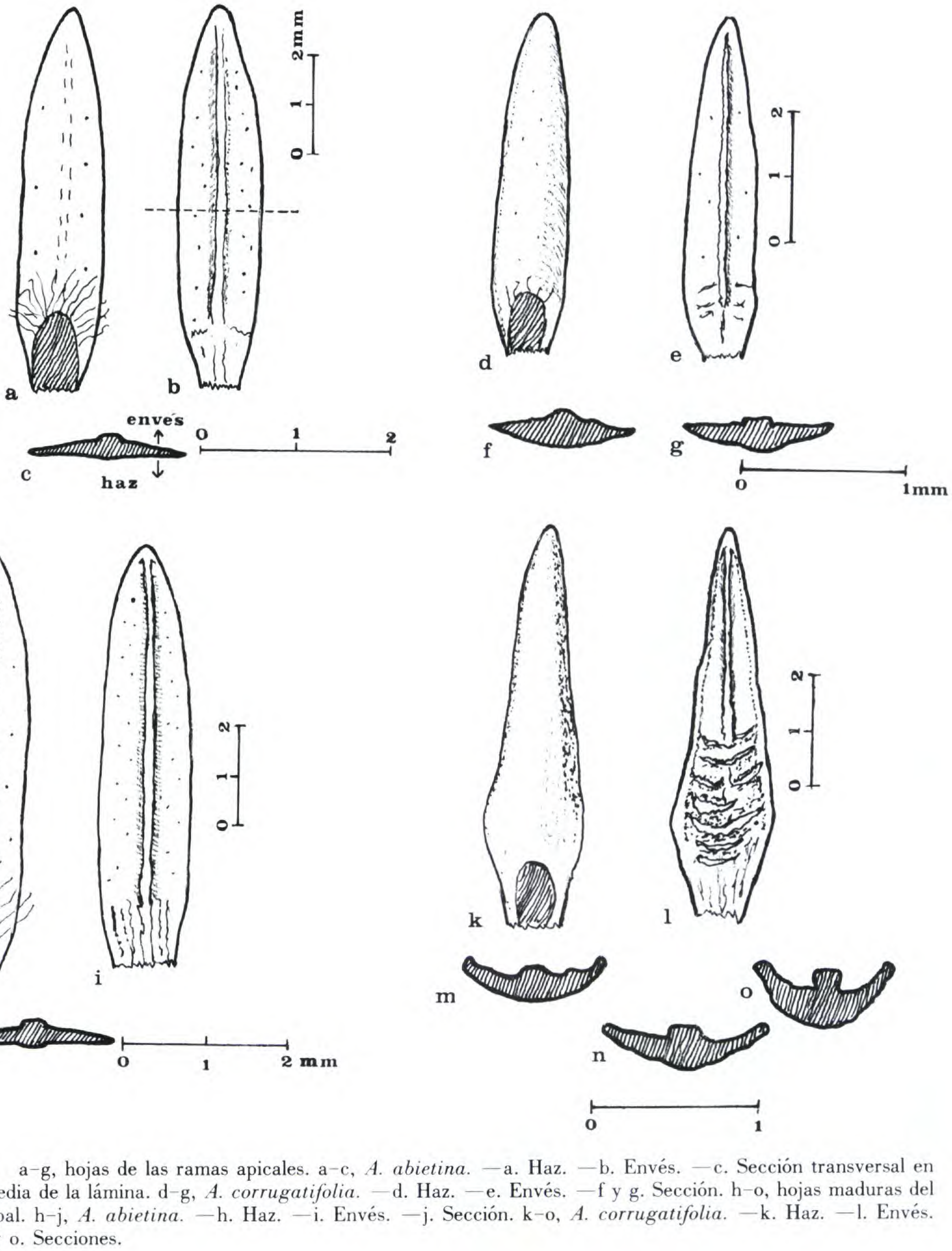

Figura 1. a–g, hojas de las ramas apicales. a–c, *A. abietina*. —a. Haz. —b. Envés. —c. Sección transversal en la zona media de la lámina. d–g, *A. corrugatifolia*. —d. Haz. —e. Envés. —f y g. Sección. h–o, hojas maduras del eje principal. h–j, *A. abietina*. —h. Haz. —i. Envés. —j. Sección. k–o, *A. corrugatifolia*. —k. Haz. —l. Envés. —m, n, y o. Secciones.

de 5 sépalos libres, ligeramente decurrentes en el pedicelo; sépalos de (4.6)5–6.5 mm de longitud y 2.5–3 mm de anchura en la parte mas ancha (tercio basal); lanceolados, agudo-apiculados, gradualmente adelgazados hacia la base, de sección canaliculada, con quilla pronunciada en mayor o menor grado en el envés, con indumento algodonoso en los márgenes y ápice (en la mitad superior); con dos zonas marginales (¼ de la anchura a cada lado) ± membranosas, zona central mas ancha, foliácea. Disco hipogino nectarífero plano, anular, de 1.7 mm de diámetro, con depresión central de ca. 0.6 mm de diámetro. Corola blanca de 10.5–13 mm de longitud (tubo + lóbulos); tubo de 4–5 mm de longitud, 3 mm de anchura en la base y ca. 4 mm a nivel de la garganta; lóbulos lanceolados u oblongo-lanceolados de 7–8 mm × 3–3.5 mm, internamente con abundante indumento algodonoso en la mitad su-

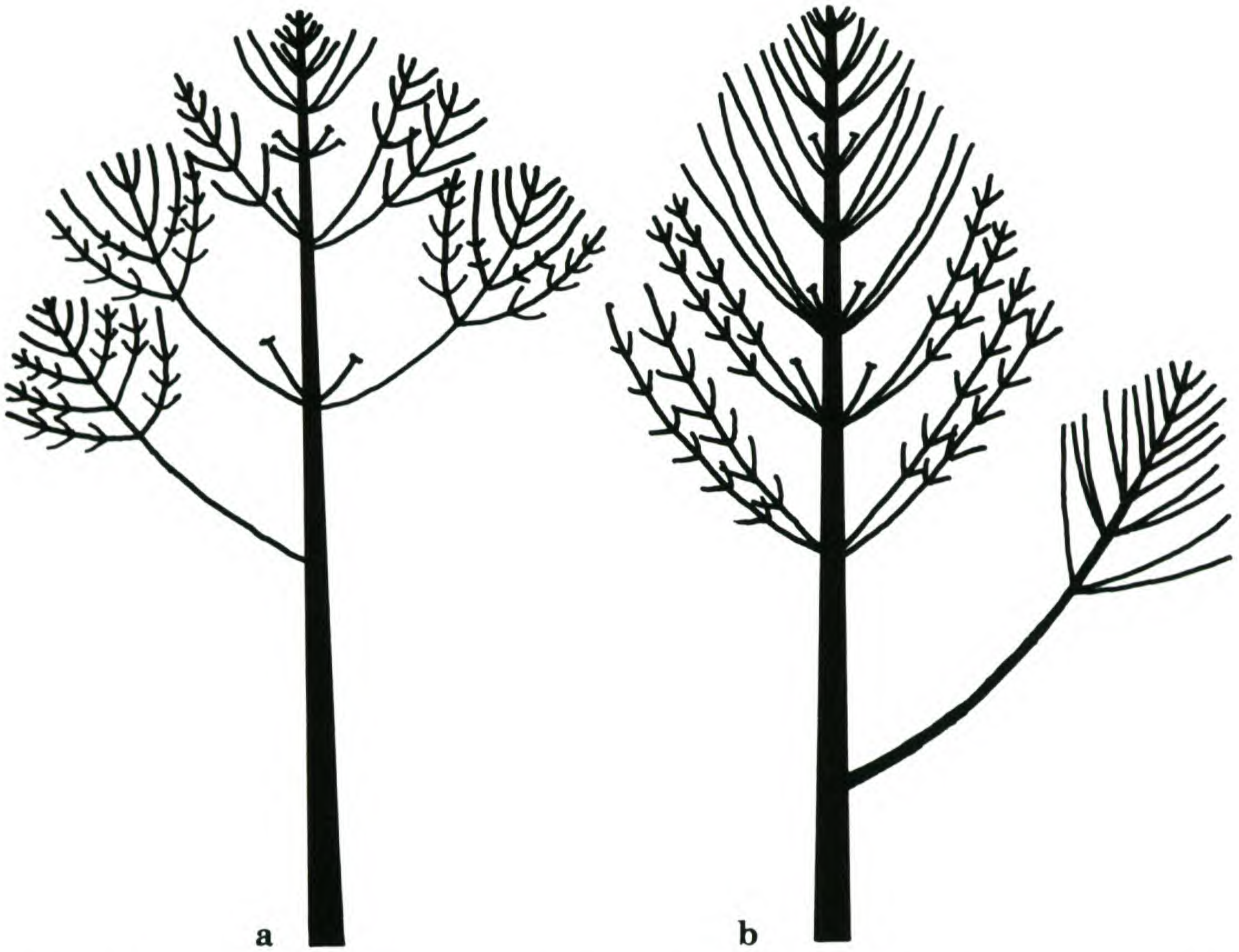

Figura 2. Esquemas de ramificación del eje principal. —a. *Aragoa abietina* HBK. —b. *Aragoa corrugatifolia* Fernández Alonso.

perior del tubo y glandular-flexuoso más corto en el ⅓ inferior de los lóbulos. Estambres 4, insertos en la parte superior del tubo de la corola, filamentos de 2.2–3.5 mm de longitud, anteras de ca. 1 × 1 mm, en forma de herradura o subtriangulares. Ovario de ca. 2 mm de longitud, estilo de 4.5–5 mm × 0.1–0.2 mm, estigma subcapitado, glabro en todas sus partes. Fruto en cápsula bilocular de 5.2–6 × 3 mm, oval-cónica, subaguda, que en longitud sobrepasa claramente al cáliz (en ca. ⅓ de su longitud); valvas 4, de 5–5.3 × 2.1–2.2 mm, estrechamente lanceoladas, agudas, concavas. Septo placentario en el fruto de ovado-lanceolado a estrechamente triangular, de 4–4.7(5) × 2.2–2.8 mm en la parte mas ancha. Semillas por lo general 3 por lóculo, adosadas al septo placentario, discoides o irregularmente discoide-elípticas, de 2.2–3 × 1.8–2 mm, con ala ancha, al menos tan ancha en todos sus lados como la parte carnosa central de la semilla; ala finamente plegado-reticulada, celdillas membranáceas dispuestas por el dorso en 12–14 filas. Semilla (sin el ala) subesférica u oval, un poco comprimida dorsalmente, de 1 × 0.8–1 mm.

Conocida sólo del Sur de la Cordillera Oriental de Colombia, en la región de Sumapaz. Crece en páramo entre 3,300–3,700 m, en general en zonas con humedad edáfica acusada.

Aragoa corrugatifolia se encuadra dentro del grupo "abietina" (Fernández Alonso, 1991; Fernández Alonso & Castroviejo, 1990) por el tipo de ramificación, hojas, y longitud del pedicelo floral. Una especie emparentada con la que se describe es *A. abietina* HBK, endémica de los páramos del centro y norte del departamento de Cundinamarca. Esta especie se separa con claridad por sus hojas de mayor tamaño, en la madurez con sección aplanada ligeramente biconvexa y láminas rigido-coriáceas, no estriado-corrugadas (Fig. 1a–c y h–j). En cuanto al tipo de ramificación (Fig. 2), en *A. corrugatifolia* se observa mayor densidad en la disposición de las ramas primarias tanto por el número de ramas por verticilo, como por la menor distancia entre éstos; además en esta especie no se observa proliferación de ramas terciarias a diferencia de lo que ocurre con *A. abietina*.

Una segunda especie emparentada es *A. occi-*

dentalis Pennell, endémica de la parte septentrional de la Cordillera Occidental de Colombia (Pennell, 1938). Entre otros caracteres se diferencia por su corola glabra en la garganta y en la base de los lóbulos. En la región de Sumapaz, se encuentra también *A. perez-arbelaeziana* Romero, incluida en el grupo "cupressina" por la disposición de hojas en los tallos y tipo de sección foliar (Fernández Alonso, 1990). Esta especie presenta además corolas amarillas y tubo de la corola de mas de 12 mm de longitud, caracteres que la separan con claridad de la que aquí se describe.

Parátipos. COLOMBIA. **Cundinamarca:** Municipio de Pasca, Vereda Cajitas, Laguna Cajitas, 3,700 m, 4 sep. 1983 (fl, fr), *Ardila, M. P. et al. 2* (BOG-3016); Distrito Especial de Bogotá, Páramo de Sumapaz, Después de la Laguna de Chisacá, "Laguna Larga" en la vía a San Juán de Sumapaz, 3,300–3,400 m, 10 nov. 1987 (fl), *J. L. Fernández Alonso, M. R. Garzón et al. 7754* (COL, MA). **Meta:** Páramo de Sumapaz, Hoya El Nevado, Lagunas El Sorbedero y El Nevado y páramos en las cercanías, aproximadamente 500 m al N de la Laguna El Sorbedero, 3,550 m, 1 feb. 1972, *A. M. Cleef 1505* (COL); Cubarral, orilla de la Laguna de La Guitarra, Páramo de Sumapaz, 3,420 m, 5 jul. 1981, *R. Franco P. & O. Rangel 158* (COL).

Clave para las Especies de *Aragoa* Grupo "Abietina"

1a. Hojas maduras espatuladas, de 2.5–3.5 mm de anchura, delgadas, de sección linear, plana .. .. *A. dugandii* Romero

1b. Hojas maduras no espatuladas, de menos de 2 mm de anchura, sección biconvexa, plano-convexa o convexo-cóncava (haz-envés).

2a. Corola no vellosa en la garganta, indumento compuesto unicamente por algunas glándulas sésiles ..... *A. occidentalis* Pennell

2b. Corola abundantemente vellosa en la garganta

3a. Ramas de tercer orden generalmente presentes, hojas jóvenes (de las ramas terminales) de 1.1–1.7 mm de anchura, hojas maduras con sección claramente plano-convexa o biconvexa, lámina no estriado-corrugada en el envés, sépalos de (6)7–8.5 mm de longitud ..... *A. abietina* HBK

3b. Ramas de tercer orden generalmente ausentes, hojas jóvenes (de las ramas terminales) de hasta 0.9 mm de anchura, hojas maduras con sección convexo-recurvada en el haz y cóncava en el envés, éste transversalmente estriado- corrugado de forma irregular en la mitad inferior, sépalos de 4.5–5(6) mm de longitud .... *A. corrugatifolia* Fernández Alonso

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Ophiochloa, a New Endemic Serpentine Grass Genus (Poaceae: Paniceae) from the Brazilian Cerrado Vegetation

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ABSTRACT. *Ophiochloa* is described and illustrated as a new, monotypic genus and new species of the Digitariinae, Paniceae, from Goiás, Brazil, characterized by ligules a row of hairs, solitary, unilateral, winged racemes that end in a sterile projection, adaxial spikelets, specialized, narrow 2-nerved lower lemma with 2 prominent setae, and hyaline, free, upper lemma and palea tips. It is a C_4 grass with Kranz anatomy. Its putative relationships are discussed. The new species is a narrow, serpentine endemic that grows on rocks along intermittent or permanent streams in the ultramafic rock belt of the cerrado of central Brazil.

Serpentine soils occur in many parts of the world, and they often support a flora that is generally poorly diversified but highly endemic (Brooks, 1987). These soils are derived from ultramafic rocks and because they are characterized by high concentrations of magnesium, iron, nickel, chromium, and cobalt plus abnormally low levels of some plant macronutrients such as potassium, calcium, and phosphorus, they provide an unusual environment for plants (Brooks, 1987).

During a recent botanical survey carried out in the municipality of Niquelândia in the Brazilian state of Goiás, where previous fieldwork had detected serpentine soil and the presence of a serpentinic adapted flora (Brooks et al. 1990; Davidse & Filgueiras, 1993; Filgueiras & Davidse, in prep.), an interesting grass was collected that could not be placed in any described genera of the Poaceae (Clayton & Renvoize, 1986; Webster et al., 1989; Watson & Dallwitz, 1992). This plant is here described as a new genus and a new species.

Ophiochloa hydrolithica Filgueiras, Davidse & Zuloaga, gen. et sp. nov. TYPE: Brazil. Goiás: Município de Niquelândia, Macedo, (14°18′S–48°23′W), ca. 20 km N da cidade, crescendo dentro dágua, sobre pedras, em pequeno riacho temporário e brejo adjacente, única população vista, 4 Aug. 1992, *T. S. Filgueiras & R. D. Lopes 2438* (holotype, SP; isotypes, CANB, IBGE, ISC, K, L, LE, MO, PRE, RB, SI, UB, UFG, US). Figures 1–3.

Leptocoryphio Nees spiculis membranaceis, flosculo superiore cuprino, lemmate superiore marginibus aplanatis apicem versus, apice hyalino et palea superiore hianti apice similis sed ligula pilis seriatis, inflorescentia racemo solitario ac axillari racemo adjecto, rhachidi alata projectura sterili in extremitate, spiculis sessilibus, gluma superiore 2-nervia, hyalina, spiculae aequanti arcte flosculum superiorem amplectanti, lemmate inferiore 2-nervio, hyalino, dense ciliato-pectinato prompter distinguitur.

Densely caespitose perennial with a dense accumulation of wiry, adventitious roots and old culm bases forming a compact mass. Culms 54–78 cm tall, erect, stiff, unbranched in the vegetative portion, with 7–11 elongated internodes; internodes hollow, glabrous, stramineous; nodes dark, glabrous. Leaves basal and cauline; sheaths rounded on the back, persisting for some time, striate, glabrous, the margins free, hyaline, glabrous, the apex much broader than the base of the blade, without auricles; ligule a minute fringe of hairs, V-shaped and continuous with the hyaline shoulder of the sheath apex, the hairs to 0.5 mm long, the hairs behind the ligule to 6.5 mm long, whitish; collar undifferentiated; blades 10–19.2 cm long, 0.5–1 mm wide, setaceous, glabrous but with a few scattered, whitish hairs to 6.3 mm long, U-shaped in cross section with an adaxial groove, becoming nearly circular toward the apex, the apex subpungent, slightly scaberulous. Inflorescences solitary, unilateral, spike-like racemes, 1 terminal and usually 1 axillary per

Figure 1. *Ophiochloa hydrolithica* Filgueiras, Davidse & Zuloaga. —A. Habit. —B. Portion of the leaf in the ligular area showing the broad, hyaline sheath margins and adaxial groove of the leaf blade. —C. Portion of the winged rachis showing the solitary, adaxial spikelets. —D. Lower portion of the spikelet showing the upper glume and the free, 2-nerved lower lemma. —E. Upper glume, flattened. —F. Lower lemma with 2 prominent setae. —G. Apex of the lower lemma showing the prominent, pectinate-ciliate nerves with the pustulose bases of the setae. —H. Spikelet viewed from the back of the upper glume. —I. Upper floret, viewed from the palea side. J–K. Caryopsis. —J. Embryo view. —K. Hilum view. [Based on *Filgueiras & Lopes 2438* (SI).]

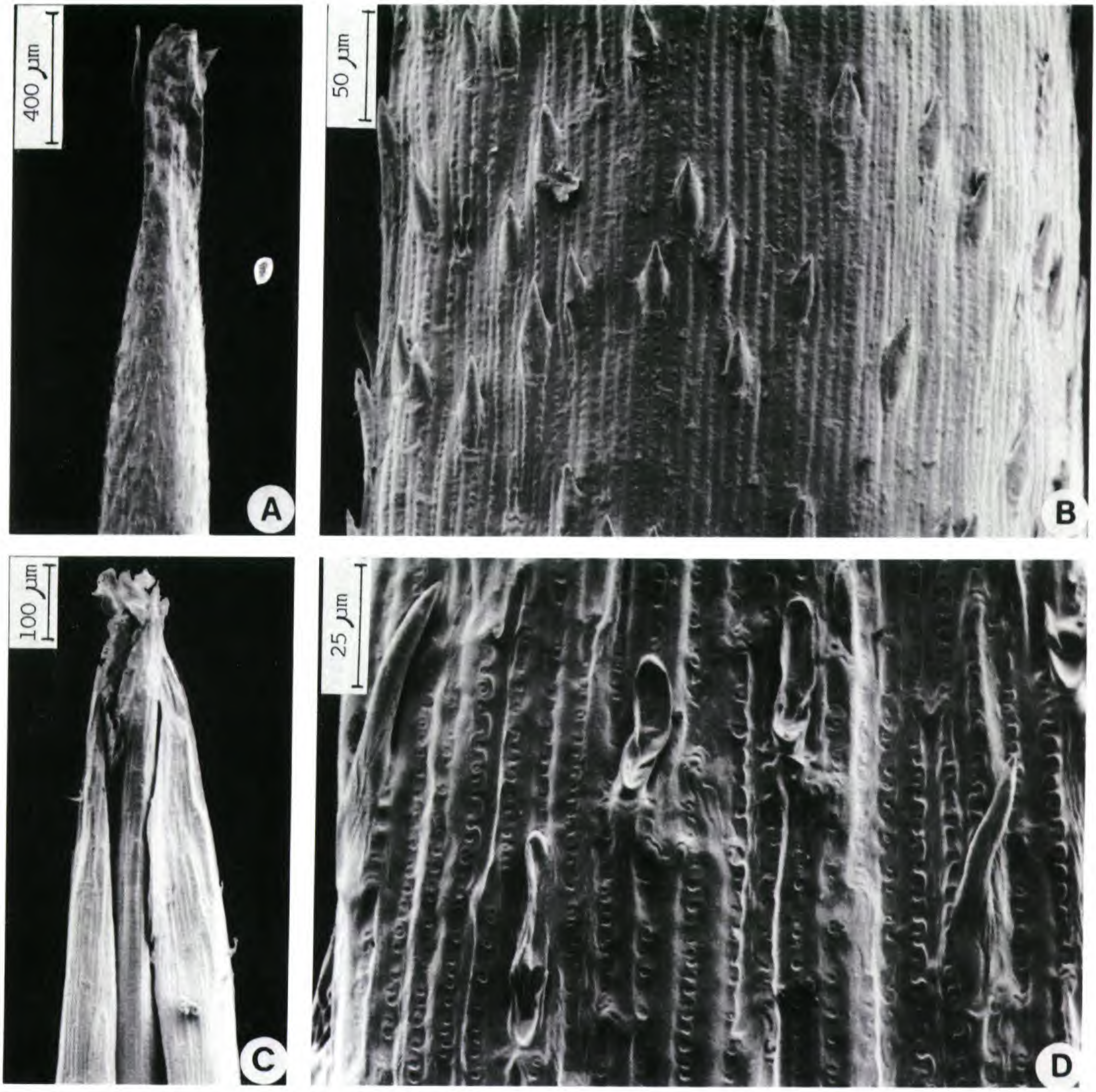

Figure 2. SEM photomicrographs of the spikelet of *Ophiochloa hydrolithica* Filgueiras, Davidse & Zuloaga. —A. Upper glume. —B. Detail of upper glume with prickle hairs and scattered bottlelike microhairs. —C. Apex of the upper floret showing the hyaline, free tips of the upper lemma and palea. —D. Detail of the upper lemma with bottlelike microhairs and prickle hairs. [Based on *Filgueiras & Lopes 2438* (SI).]

culm; peduncles 6–21 cm long, well exserted, delicate; prophyll at the base of the axillary branch 2-keeled, membranous, pale, about half as long as the subtending leaf sheath; racemes 6.6–9.2 cm long, erect to drooping at maturity, acuminate apically; rachis winged, the wings 0.9–1.1 mm wide, membranous, partially enclosing the spikelets, the central portion light green, nerved, the midrib shortly ciliate and narrowly winged with colorless, hyaline tissue, the marginal wings hyaline, colorless, rarely purplish, irregular, glabrous or sparingly ciliate, the rachis apex extending beyond the spikelets as a sterile projection to 5 mm long; pedicels minute, to ca. 0.5 mm long, adnate to the midrib. Spikelets 2.3–3.1 mm long, 0.4–0.5 mm wide, solitary, awnless, all alike, bisexual, alternately arranged on each side of the midrib, dorsally compressed, adaxial, narrowly oblong-lanceolate in outline, disarticulating below the glume and falling as a single unit, with 2 florets; lower glume absent; upper glume as long as the spikelet, 2.3–3.1 mm long, faintly 2-nerved, colorless, hyaline, glabrous, the surface covered by prickle hairs and with scattered bottlelike microhairs, embracing the upper floret but leaving the lower lemma free in mature spikelets, acute apically, the apex irregularly erose and minutely ciliolate; lower

floret sterile, without a lower palea, consisting only of a lower lemma 1.5–2.0 mm long, narrow, hyaline except for the stout nerves, colorless, strongly 2-nerved, the apex acute, ciliolate, the nerves marginal, densely pectinate-ciliate, the cilia to 1.5 mm long, with bulbous bases, whitish, the uppermost cilia on each side of the margins 5–7 mm long, stout, equal to subequal in size, rarely unequal, flexuous, straight or curled; upper floret 1.9–2.2 mm long, copper-colored, bisexual; upper lemma 1.9–2.2 mm long, indistinctly nerved, membranous except at the apex, covered with numerous bottlelike microhairs and a few prickle hairs, a germination flap not evident, the margins undifferentiated, somewhat inrolled in the lower half, flat and free from the palea in the upper $\frac{1}{5}$–$\frac{1}{6}$, the apex acute, colorless, hyaline; upper palea 1.8–2.2 mm long, colorless, hyaline, 2-nerved, the apex minutely 2-notched, gaping; lodicules 2, conduplicate, ca. 0.1 mm long; ovary ca. 0.2–0.3 mm long; styles 2, separate; stigmas 2, plumose, yellow or purple, terminally exserted; stamens 2, rarely 3, terminally exserted, the anthers 1.3–1.7 mm long, purple. Caryopsis narrowly obovate to clavate, 1–1.2 mm long, ca. 0.2 mm wide, with persistent stylar bases, vinaceous; embryo $\frac{4}{10}$–$\frac{5}{10}$ as long as the caryopsis; hilum punctate-oblong, basal, $\frac{1}{10}$–$\frac{2}{10}$ as long as the caryopsis.

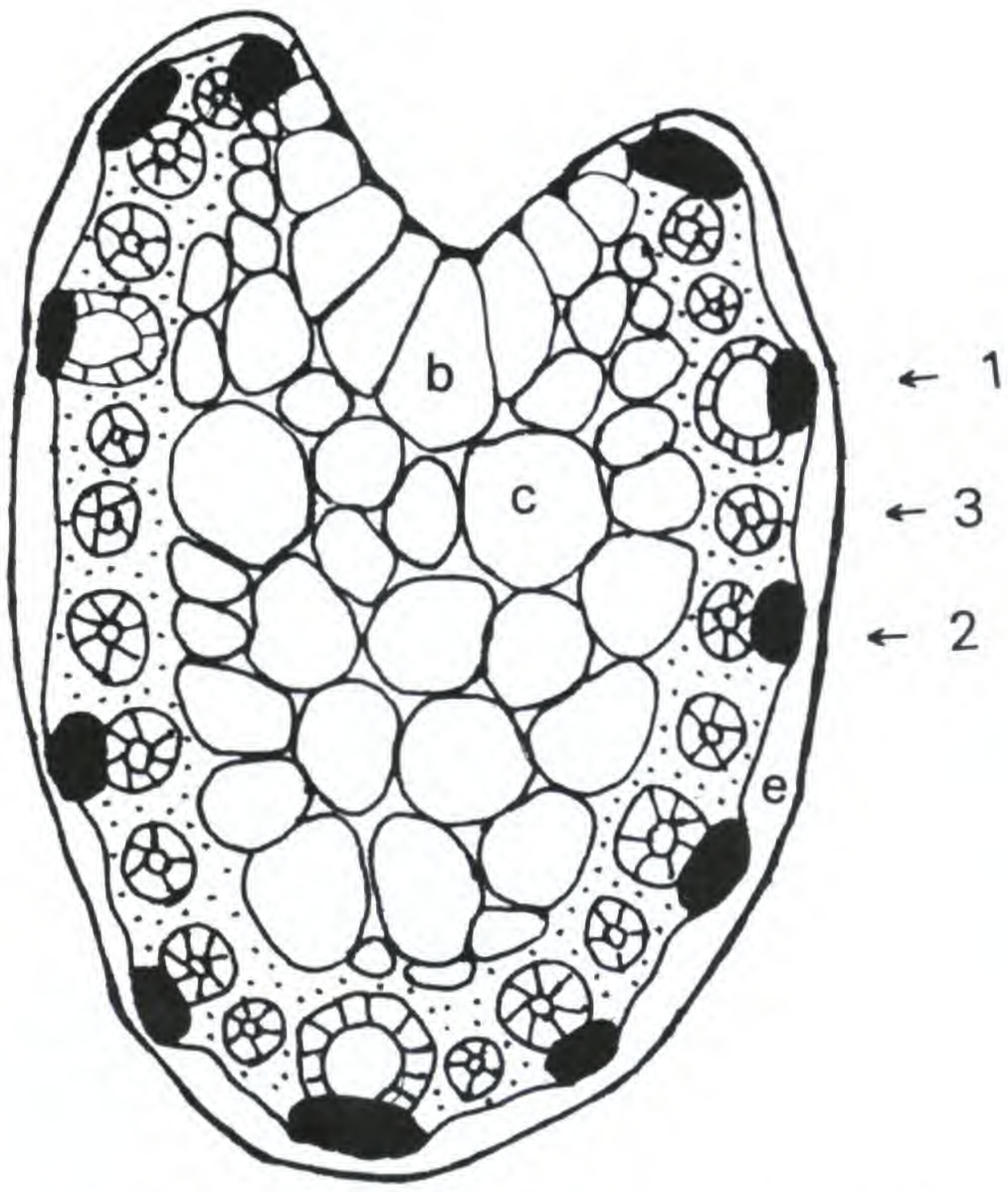

Figure 3. Diagrammatic cross section of leaf blade of *Ophiochloa hydrolithica* Filgueiras, Davidse & Zuloaga. Solid black = sclerenchyma strands; stippled area = chlorenchyma; b = bulliform cells; c = colorless cells; e = epidermis and cuticle; 1 = first-order vascular bundle; 2 = second-order vascular bundle; 3 = third-order vascular bundle. Scale line = 0.1 mm. [Based on *Filgueiras & Lopes 2438* (MO).]

Paratypes. BRAZIL. **Goiás:** Niquelândia, Fonte da Bica, ca. 10 km da cidade, 19 May 1993, *T. S. Filgueiras & F. C. de A. Oliveira 2466* (G, IBGE, ICN, MEXU, MO, R, RB, SPF); mata galeria, 19 May 1993, *T. S. Filgueiras & F. C. de A. Oliveira 2460* (IBGE, sterile); Macedo, 19 May 1997, *T. S. Filgueiras & F. C. de A. Oliveira 2452* (IBGE, UEC).

Spikelet interpretation in *Ophiochloa* is not without difficulty, primarily because of the unusual structure of the second bract, which, although certainly not homologous, nevertheless somewhat resembles the pedicel of a *Bothriochloa* Kuntze pedicellate spikelet because of the hyaline central portion, well-developed, marginal, pectinate-ciliate nerves, and lack of tissue to the outside of the nerves. Furthermore, the basal margins of the first bract do not overlap the narrow base of the second bract so that the relative position of these two bracts is somewhat ambiguous. Because it is prominently 2-nerved, there is thus a question whether this bract represents the lemma or palea of the lower floret. However, in very young spikelets still enclosed within the sheaths in which the large cilia are not yet divergent, the margins of the lower bract do embrace the nerves and cilia of the second bract, at least in the upper $\frac{3}{4}$. This is consistent with the relative position of the lower lemma in a Paniceae spikelet. As discussed further below, it also seems homologous to the somewhat similar 2-nerved lower lemma of *Paspalum ceresia* (Kuntze) Chase, a species where this bract clearly represents a lower lemma. Finally, as far as we know, the lower floret of the Paniceae is never reduced to only a palea, whereas it is frequently reduced to only a lemma.

Ophiochloa is tentatively placed in subtribe *Digitariinae* Butzin, sensu Clayton & Renvoize (1986), because of the dorsally compressed spikelets, upper glume as long as the spikelet, lower floret reduced to a membranous sterile lemma, upper lemma membranous with the apex hyaline and not enclosing the palea, and palea hyaline and free at the apex. However, the following combination of characters make it unique in the subtribe: ligule a row of minute hairs without any membrane, solitary racemes that are both terminal and axillary and that end in a sterile projection, adaxial spikelets, hyaline, 2-nerved, colorless upper glume embracing the upper floret but leaving the lower lemma free, 2-nerved, hyaline lower lemma. *Ophiochloa* is an odd member of the subtribe, but homogeneity is not by any measure a characteristic feature of the group (Clayton & Renvoize, 1986).

The relationships of the new genus within subtribe Digitariinae are not readily apparent and therefore merit special remarks. Based primarily on the sim-

ilarity of the morphology of the spikelets, *Ophiochloa* appears to be most similar to *Leptocoryphium* Nees and *Anthaenantia* P. Beauvois. They are alike in lacking a lower glume and in having a membranous or somewhat cartilaginous, copper-colored or dark brown upper floret with hyaline tips, and a palea free from the lemma apex. But *Ophiochloa* is readily distinguished from these because in both genera the inflorescence is an open panicle, the spikelets are long pedicellate, the pedicel apex is cupulate, and the upper glume and lower lemma are similar in size and texture and 5-nerved. Although the texture of the upper lemma in *Anthaenantia* and *Leptocoryphium* is not indurate, it is clearly firmer than that of *Ophiochloa*. [Although both Clayton & Renvoize (1986) and Watson & Dallwitz (1992), describe the spikelets of *Anthaenantia* as laterally compressed, they are clearly dorsally compressed, with the side of the lower lemma somewhat flattened in comparison to the side of the upper glume.] Four other genera in the Digitariinae, *Acritochaete* Pilger, *Baptorhachis* Clayton & Renvoize, *Megaloprotachne* C. E. Hubbard, and *Stereochlaena* Hackel, all African, have racemes with unilateral spikelets. However, all have paired, clearly pedicellate spikelets. *Baptorhachis* is most similar in that it is the only genus of the four with a solitary raceme and a winged rachis, and the lower glume absent. However, *Baptorhachis* differs from *Ophiochloa* by its annual habit, ciliolated membranous ligule, raceme rachis ending in a spikelet, paired spikelets, upper glume and lower lemma awned, 3-nerved, the lateral nerves thickened and bearing a dense tuft of hairs, the upper lemma tightly clasping the upper palea, and stamens 3 (Clayton & Renvoize, 1986; Watson & Dallwitz, 1992).

Ophiochloa also resembles species of *Digitaria* Haller in sect. *Solitaria* Hackel because of the shortly pedicellate, solitary spikelets in two rows on a winged rachis, but in these species the upper glume is never 2-nerved and hyaline and it does not tightly embrace the upper floret, leaving the lower lemma free. Furthermore, the spikelets are abaxial, the racemes are always several to many, the upper floret is indurated, and the tips of the upper lemma and palea are not hyaline.

Outside the Digitariinae, *Ophiochloa* bears the closest resemblance to *Axonopus* P. Beauvois, [Setariinae Dumortier, sensu Clayton & Renvoize (1986)] especially in inflorescence structure and spikelet orientation. They share the following characters: unilateral racemes, axillary inflorescences, adaxial spikelets, lower glume absent, delicate texture of the upper glume and lower lemma, lower floret reduced to a lemma, upper floret frequently brown, and rachis sometimes winged. However, *Axonopus* is quite distinct in the more indurate upper floret in which the upper lemma and palea is never hyaline at the apex and the palea apex is always enclosed by the lemma, the lower lemma is never narrowed and is always enclosed by the margins of overlapping of the upper glume, and the racemes are two to numerous (rarely one in axillary inflorescences).

Two other genera of the Setariinae with unilateral racemes, solitary spikelets, membranous or chartaceous upper florets, and a free palea apex are *Reimarochloa* Hitchcock and *Paratheria* Grisebach. However, both genera have abaxial spikelets. Furthermore, *Reimarochloa* is quite distinct on the basis of its stoloniferous habit and spikelets lacking both glumes. *Paratheria* is very different in having each raceme deciduous and falling as one unit with the single attached spikelet, the basal portion of the raceme rachis forming a pungent callus with the rest of the raceme functioning like an awn.

Another genus of the Setariinae with adaxial, solitary, racemes and sometimes awnless spikelets is *Mesosetum* Steudel. *Ophiochloa* resembles *Mesosetum* by the solitary raceme, the adaxial spikelets, the foliaceous rachis of the species in section *Bifaria* (Hackel) Chase, and the pectinate hairs of the lower lemma (Filgueiras, 1989). However, they differ in that *Mesosetum* typically has terminal inflorescences [except *M. chlorostachyum* (Doell) Chase, an annual with terminal and axillary inflorescences], a well-developed lower glume, coriaceous upper glume, 5–7-nerved lower lemma, indurate upper floret, and a linear hilum.

Ophiochloa is superficially similar to the species of *Paspalum* L. subgen. *Ceresia* (Persoon) Reichenbach because of the winged rachis and the sessile spikelets, but in *Paspalum* the spikelets are always abaxial when solitary, and the upper floret is indurate to chartaceous (except in the anomalous *Paspalum saccharoides* Nees with membranous upper floret, and palea longer than the lemma and free at the apex). However, a striking similarity exists between the lower lemma of *Paspalum ceresia* and that of *O. hydrolithica* because they are both narrower than the upper lemma, 2-nerved, and hyaline between the pectinate-ciliate nerves. However, in *P. ceresia* there is a very narrow strip of hyaline tissue on the outer edge of the nerves, whereas this is not present in *Ophiochloa*, i.e., its nerves are strictly marginal. In *P. ceresia* the lemma bears a tuft of stout cilia at the apex.

A clear relationship to *Thrasya* Kunth, which

also has solitary, frequently winged racemes with unilateral spikelets and the apex of the raceme rachis ending in a sterile projection, is excluded because the genus is characterized by alternately adaxial and abaxial spikelets borne in one row due to the adnation of the pedicels of the spikelet pairs to the rachis (Burman, 1985).

The two stout setae at the tip of the margins of the lower lemma of *O. hydrolithica* are quite remarkable as they are hygroscopic. They seem to be functionally comparable to awns and probably play a role in fruit dispersal or fruit positioning for better seedling establishment. The size of these setae was found to be variable. In the spikelets at the base of the raceme they tend to be unequal, with one sometimes considerably shorter than the other. Stout setae can be found in the upper glume and on the lower lemma of several species of *Paspalum* subgen. *Ceresia*, such as *P. bicilium* Mez, *P. heterotrichon* Trinius, *P. polyphyllum* Nees, *P. setiglume* Chase, and *P. trachycoleon* Steudel.

The relative distance between adjacent spikelets is increasingly shorter from the base to the apex of the raceme; consequently, the basal spikelets are relatively distant from each other and the upper ones are congested.

The great majority of the flowers examined had only two stamens, but occasionally flowers with three stamens were also found. Whereas the color of the anthers was always a deep purple, the color of the stigmas varied from yellow to purple in the same raceme.

Anatomy

Gross cross-sectional leaf anatomy was determined from hand-sectioned blade cross sections on temporary slides. The sections were stained in 0.05% Toluidine Blue O in acetate buffer. A diagrammatic cross section made with the aid of a camera lucida is presented as Figure 3.

The blades are permanently infolded and form a reduced U-shape with a shallow groove on the adaxial surface. Three first-order vascular bundles are present, one in the midrib and one each towards the margins. Second-and third-order vascular alternate between the midrib and the marginal first-order bundle, or sometimes up to three side-to-side third-order bundles may be present. All vascular bundles have a single Kranz bundle sheath with chloroplasts that tend to be centrifugally arranged. However, the chloroplasts are large and fill most of the lumen of the bundle sheath cells so that their position in the cell is not certain. There are no cells between the Kranz cells and the metaxylem elements. The Kranz cells of the third-order vascular bundles are the largest in cross section. Sclerenchyma is present only as abaxial strands below the first-and second-order bundles. The sclerenchyma strands interrupt the bundle sheath of first-order vascular bundles but not that of the second-order vascular bundles. The chlorenchyma is indistinctly radiate with only one or two cells between adjacent vascular bundles. There is also usually one cell between the third-order vascular bundles and the epidermis, and between all vascular bundles and the colorless cells. The central portion of the blade is filled with large colorless cells. These colorless cells abut a single row of prominent inflated bulliform cells that make up the adaxial epidermis.

Following the terminology of Hattersley & Watson (1976), *O. hydrolithica* has Kranz, MS (=XyMS−) anatomy. Because of the well-established correlation in the Kranz syndrome between anatomical and physiological characters (Brown, 1977; Ellis, 1977; Hattersley, 1987), we conclude that *O. hydrolithica* is a C_4 species of the NADP-me physiological type or a malate former (Gutiérrez et al., 1974).

Ecology

Ophiochloa hydrolithica is known from three distinct populations: Macedo (the original population discovered in 1992), Mata Galeria, and Fonte da Bica (discovered in 1993). The Macedo population is about 50 m from a road and is very close to a nickel mining operation. Here *Ophiochloa* grows on rocks in running water in a seasonal rivulet and the adjacent marshy area. The population is about 15 m long and 2–3 m wide. The rather caespitose, wiry looking plants grow only along the drainage line, and where the water from the rivulet sinks into the ground in a nearby campo limpo, plants of *Ophiochloa* can no longer be found. Practically all the plants in this population showed some sign of having being previously burned. Although they grew in wet areas, the rivulet dries out in the dry season (May through September), thus exposing the plants to fires.

The Mata Galeria population is located about 2 km E of the Macedo population. These two populations are separated by two steep hills and belong to two different subwatersheds. This appears to be the healthiest of the three populations. Its size is about the same as the Macedo population, but the plants grow in dense, thick stands, and are lush and green in color. The gallery forest itself is about 200 m long and 3–5 m wide. It is located in a remote

area that is difficult of access because the terrain is rugged and stony. As in the Macedo population, the water stops flowing in the dry season. Here *Ophiochloa* grows on rocks in partial shade of the gallery forest, never in the soil.

The Fonte da Bica population is located about 10 km S of Macedo, and apparently is the least fit of the three populations. There are three reasons for this. First, the plants are less dense, i.e., only about 50 clumps were seen, contrasting to over 100 in the other populations. Second, the entire area is fully exposed without any trees or shrubs. Third, there is some disturbance due to human influence in the area as people stop by to drink and collect water from a spring that originates from the bottom of a steep hill situated just beyond the *Ophiochloa* population. In fact, plants of *Ophiochloa* that grow by the "bica" itself are trampled and display a sickly appearance. Dust from an unpaved road nearby covers most plants during the dry season. In this population water flows throughout the year.

The highly specialized habitat of *Ophiochloa* appears to be rare in the area surveyed, and the species is not likely to be abundant elsewhere, although other populations may eventually be found along the ultramafic rock belt of central Brazil. Like the two sister species of *Paspalum* recently described from the same site (Davidse & Filgueiras, 1993; Filgueiras & Davidse, in press), *O. hydrolithica* faces serious threat of imminent extinction due to the nickel mining and smelting operation now taking place at the type locality (Macedo) of this unique serpentine grass. So far no attempt has been made to bring the plant into cultivation.

The generic name refers to a grass that grows on serpentine (ophiolite) rock and the specific epithet refers to a plant that grows on rock in the water.

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Studies in *Schefflera* (Araliaceae), VI. New Species and Subordinate Taxa in the Venezuelan Guayana and Immediately Adjacent Areas

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ABSTRACT. A study of the Venezuelan Guayana species of *Schefflera* (Araliaceae) as part of a family treatment for the forthcoming *Flora of the Venezuelan Guayana* calls for recognition of 30 species not included in the 1984 summary by Maguire, Steyermark & Frodin or a later paper by Steyermark & Holst. Twenty-two species are described here, 12 of them from collections made since 1981, and 8 species are elevated from infraspecific rank. Together with 28 previously recognized species, a total of 58 species are now known from the Venezuelan Guayana and immediately adjacent parts of Brazil and Guyana. Of these, 55 species are endemic or nearly endemic to the region. At the infraspecific level, a new variety is described as *Schefflera chimantensis* subsp. *rugosifolia* var. *iluensis; Didymopanax multiramosus* Steyermark is restored at subspecific rank within *S. chimantensis;* and *S. rugosifolia* Maguire, Steyermark & Frodin is reduced to subspecific rank within the same species. Two previously known species are renamed for nomenclatural reasons. The Venezuelan Guayanan species of *Schefflera* belong to four distinct groups within the genus, for which brief synopses are provided.

Twenty-nine species of *Schefflera* (Araliaceae) were recognized in the Guayana Highland in the most recent revision by Maguire et al. (1984) and a later paper by Steyermark & Holst (1988). Reassessment of the genus for the family treatment of the forthcoming *Flora of the Venezuelan Guayana* has led to the recognition of 30 species not previously accounted for. Twenty-two of these are new to science, and eight were previously described as infraspecific taxa. Two additional undescribed species are known, but their description must await more complete material. One of the 29 previously recognized species, *S. rugosifolia*, is reduced here to a subspecies of *S. chimantensis*, and a new variety is assigned to it. This now results in a total of 58 species of *Schefflera* for the three Venezuelan Guayanan states (Amazonas, Bolívar, Delta Amacuro) and immediately adjacent parts of Guyana and Brazil. Most of the species are extremely localized in their distributions, and all but three are endemic to the region. A complete key to the species will appear soon in the *Flora of the Venezuelan Guayana*, so it will not be repeated here.

The 58 species of *Schefflera* in the Venezuelan Guayana belong to four fairly distinct but informally recognized infrageneric groups, as follows:

1. "Sciadophyllum" group (formerly *Sciadophyllum* P. Browne). Two species of rambling, large shrubs or climbers occur in the Venezuelan Guayana, *S. duidae* and *S. quinquestylorum*, mainly at mid-elevations. They are closely related to other species in the group, which is centered in the northern Andes from Colombia to Peru and has some 50–100 species, depending on how the species are eventually delimited. Additional species occur in western Venezuela, southern Central America, and Jamaica, and the widespread *S. sprucei* (Seemann) Harms extends south to the Brazilian state of Acre.
2. "Didymopanax" group (formerly *Didymopanax* J. Decaisne & Planchon). In the Venezuelan Guayana, this group has six species of small to large trees, occurring mostly below 1,000 m and including *S. morototoni* (Aublet) Maguire, Steyermark & Frodin, which is widely distributed throughout Central and South America. The Guayana is an important center of endemism and specialization in this group, paralleling other nodes such as the central Brazilian highlands and the *mata atlantica* in Rio de Janeiro state. All species are arborescent, some exceeding 30 m tall. *Schefflera decaphylla* (Seemann) Harms was treated in Maguire et al. (1984) but does not occur within the Venezuelan Guayana.
3. "Cheilodromi" group. This is a more characteristically Guayanan group, all members of which are terrestrial and mostly arborescent, but not exceeding 20 m tall. In the Venezuelan Guayana, there are 16 species of shrubs or small to medium trees in this group, mostly at mid-elevations and best represented in central Guayana. They are closely related but show affinities to species in

the *S. attenuata* alliance in the Venezuelan coastal mountains, Central America, and the West Indies (Frodin, 1989). The two alliances appear linked by *Schefflera ayangannensis* Maguire, Steyermark & Frodin, a species that occurs east of the Venezuelan Guayana in the Merume Mountains of Guyana and is isolated from the main centers of diversity in the group.

4. "Crepinella" group (formerly *Crepinella* E. Marchal). This is the most speciose of the four groups in the Venezuelan Guayana, with 34 species that are mostly limited to the region. These are usually trees under 20 m high and occur from the lowlands up to 2,800 m. Upon further study, several more or less distinct series may be recognized in this group. Members are found throughout the Venezuelan Guayana except in Delta Amacuro, but few range beyond this region. Two species occur on Serra Aracá in the Brazilian state of Amazonas (Prance & Johnson, 1992), one on Serra Sincor in central Bahia, two in eastern Colombian Guayana (*Schefflera japurensis* and *S. spruceana*), and two in Peru (*S. harmsii*, *S. spruceana*). *Schefflera spruceana* also occurs south of the Amazon River at scattered localities as far distant as Mato Grosso.

The large increase in species now being recognized in the Venezuelan Guayana compared to the last treatment in 1984 is due largely to recent collections from mountains and other areas that were previously poorly sampled or else not collected at all. Twelve of the 23 taxa described in this paper are based on collections made in the last decade. The large Maigualida–Uasadi mountain complex, for example, was not shown by Maguire (1979) in his geographical subdivision of the Guayana Highland and was first visited by botanists in 1988. Even the Sierra de la Neblina, which was the object of expeditions organized by Bassett Maguire in the 1950s and 1960s and by Venezuelans in 1983 to 1987 (Brewer-Carías, 1988), will probably still yield further novelties with greater fieldwork (cf. Huber & Frame, 1989). The summit of Roraima-tepui, which has been explored since the late 19th century, has yielded a novelty in *Schefflera dissidens*. Uplands including the talus slopes, which were singled out by Huber & Frame (1989) and by Steyermark (1979) as particularly worthy of attention, have yielded *S. yutajensis* (Steyermark & Holst, 1988) and some of the new taxa described here, including *S. disparifolia* from eastern Bolívar state. Still, many species remain known from only one or two collections, and care must be taken to extrapolate patterns from an excessively small or nonrandom sample (e.g., Nelson et al, 1990).

Another reason for the increase in species recognized is the reevaluation of material that was previously available for the *Schefflera* treatment of Maguire et al. (1984). This includes elevating to species rank seven subspecies and recognizing nine other novelties among previously examined specimens. In this paper, I have made greater use of leaf and inflorescence characters than before, which has allowed the recognition of additional species. Geographical and ecological differences have also been used to support species distinctions, and some prior misidentifications have been corrected. The distinctions upon which some of the proposed species are based are admittedly small, but no less so than for species pairs such as *Schefflera yutajensis* and *S. quinquecarinata* (Steyermark & Holst, 1988) or, in Africa, *S. lukwangulensis* and *S. umbellifera*. I strongly believe that distinctions of interest should be put on record, especially with changing ideas about the units of biodiversity and their increasing ontological significance.

The several infraspecific epithets transferred here to specific rank are retained as far as possible following Recommendation 61A.4 of the *Code* (Greuter et al., 1988).

New Species and Combinations

Schefflera acaropunctata Frodin, nom. et stat. nov. Basionym: *Schefflera umbellata* subsp. *duidana* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 74. 1984. TYPE: Venezuela. Amazonas: Cerro Duida, summit, slopes of Ridge 25, 5,500–6,000 ft., 16 Dec. 1928, *Tate 431* (holotype, NY).

Shrub or treelet 1.5–3.5 m tall, sometimes of bushy habit; twig segments glabrous, generally short, to 9 cm long, usually forking at each iteration. Leaves closely spaced, digitately compound, 3–5-foliolate; petioles 4.5–10 cm long, the basal sheath when dry pulling away from the twig but without a distinct stipular ligule; petiolules 0.7–2 cm long. Blades in a single plane, usually elliptic to oblong-elliptic, 5–10.5 cm long, 2–5 cm wide, coriaceous; surfaces contrasting, glabrous and shining above, dull and finely sericeous to whitish pubescent below with a prominent, strongly raised, in cross section somewhat squared-off midrib and often with minute domatia in the axils of the primary veins; apex rounded, the tip usually very slightly emarginate, base ± obtuse and usually slightly decurrent, and margin curved downwards; lateral veins numerous,

very fine, spreading, the secondary veins about as well developed as the primary ones. Inflorescence morphogenetically terminal but quickly surrounded by the (usually 2) actively leafing successor twigs, compound-umbellate; primary rays 2–4, ± ascending, each ray 7–24 cm long, generally very dark or even blackish when dry and usually with 1 ± prominent node in their lower part; secondary rays 6–16 or more, golden-brown pubescent, all terminal and ± ascending, 2–5 cm long, each usually with 2 or 3 minute bracts at a naked node about midway up. Flowers terminal, usually simply umbellulate or sometimes with once-reiterating outer units with peduncles to 1.8–1.9 cm long; pedicels coppery-sericeous, 4–9 mm long, each with a minute rounded bracteole at the base; calyx rim 1 mm across, with 5 minute teeth; petals 5, opening from the apex and spreading before falling; stamens 5; ovary obconic, to 2 mm long; disk ± flat, rising into a stylar column up to 1 mm long or so. Fruit usually 4- or 5-locular, remaining wholly inferior, globose toward maturity, up to 5 mm long; calyx rim to 2 mm across; stylar column to 2 mm long, only slightly dividing at top into 4 or 5 free, laterally spreading ends.

Schefflera acaropunctata is apparently a sister species to *S. huachamacarii* Maguire, Steyermark & Frodin, but differs from it in possessing 4- or 5-locular ovaries (3-locular in *S. huachamacarii*), 2–4 primary rays in the inflorescences (vs. 1 in *S. huachamacarii*), and usually 5 instead of 3 leaflets. The two species belong to the same complex of tepuis, but Cerro Huachamacari is separated and somewhat lower than Cerro Duida and Cerro Marahuaca.

Gleason (1931) referred the first collections of this species to *S. umbellata* (N. E. Brown) Viguier, based on superficial resemblances in the leaflets. However, the leaflet bases in *S. umbellata* are narrower, and the lateral venation is somewhat more coarse. In addition, the ovary is (2-)3–5-locular and the inflorescence is more robust. These differences initially suggested to me that a new species was involved, but Maguire et al. (1984: 74) retained the connection with *S. umbellata*, at least for Tate's material. The newer collections, all from Cerro Marahuaca, were previously misassigned to *S. coriacea* subsp. *neblinae* Maguire, Steyermark & Frodin. That taxon has otherwise been recorded only on one of the outliers of Cerro de la Neblina (with another record, here described as *S. varisiana*, in the Sierra Parima). However, the Marahuaca plants lack the subsidiary whorl of secondary inflorescence rays seen in the type of that taxon; and the leaflets are shorter for their width, the inflorescence is smaller, and the ovary is usually 4- or 5-locular instead of 3-locular. For these reasons, they are best placed under *S. acaropunctata*.

Similar foliar units and relatively small inflorescences may also be seen in *S. montana* (Gleason) Maguire, Steyermark & Frodin. However, the leaves of this taxon are simple, the ovary is 2-locular, and it is generally found at lower elevations.

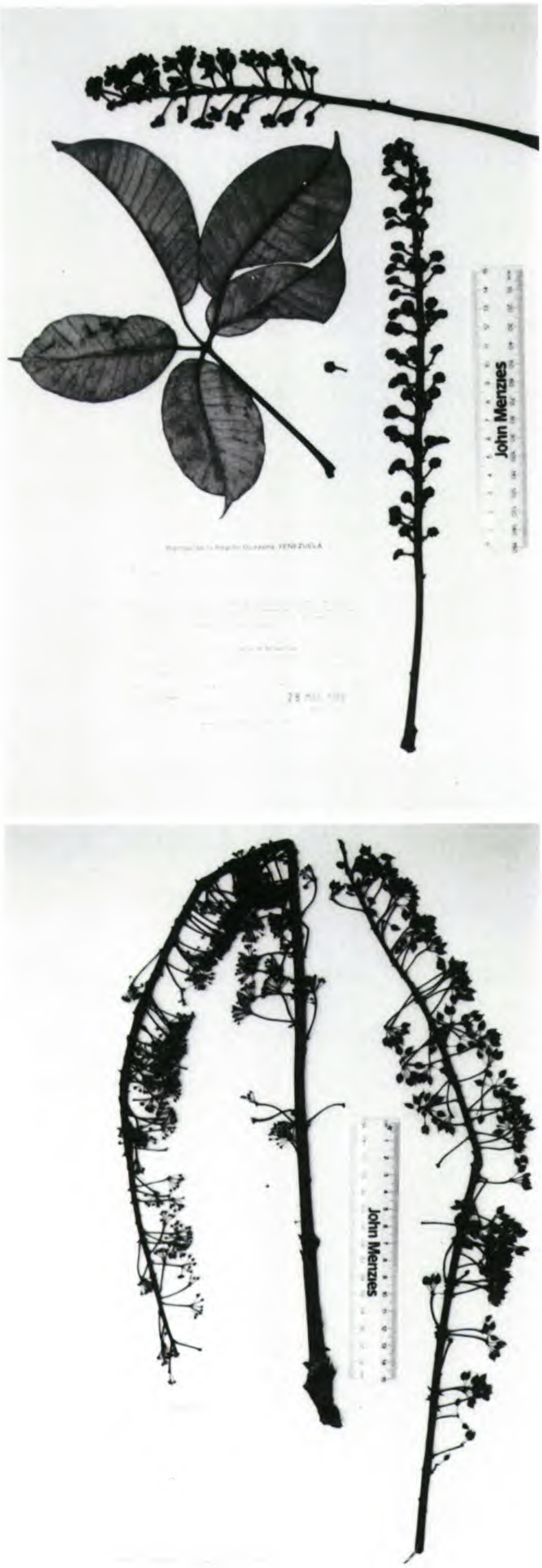
On Cerro Marahuaca, *Schefflera acaropunctata* inhabits shrub islands in open, often rocky places or grows in woods on slopes or along creeks. Along with the very different *S. tremuloidea* Maguire, Steyermark & Frodin, it is the best represented of *Schefflera* species there. The specific epithet relates to the frequent presence of minute domatia in the axils of the veins on the undersurface of the leaflets.

Additional specimens examined. VENEZUELA. **Amazonas:** Cerro Duida, summit, Desfiladero, 6,100 ft., Aug. 1928–Apr. 1929, *Tate 695* (NY). Cerro Marahuaca: summit, SE quarter, on tributary of headwaters of Río Iguapo, 2,555 m, 25 Feb. 1981, *Liesner 17961A* (MO, NY); summit on SE corner, 2,700 m, 12 Oct. 1988, *Liesner 24683* (MO); summit, SW side of center, 2,660 m, 22 Oct. 1988, *Liesner 25194* (MO); cumbre, sección SE, vecinidades del zanjón, 2,685 m, 15 Jan. 1981, *Maguire et al. 65596* (MO, NY, VEN not seen); cumbre, sección noroccidental, 2,500 m, 16 Feb. 1981, *Steyermark et al. 124387* (MO, NY, VEN not seen); cumbre, sección noroccidental, 2,500 m, 16 Feb. 1981, *Steyermark et al. 124452* (MO, VEN not seen); Huha, cumbre, altiplanicie no arbolada, 2,580 m, 31 Jan. 1982, *Steyermark et al. 125961* (NY, VEN not seen); Fhuif, cumbre, zona boscosa en la falda E del riachuelo, 2,480–2,500 m, 1–2 Feb. 1982, *Steyermark et al. 125986* (NY, VEN not seen); cumbre, extr. NE, 2,580–2,600 m, 30 Mar.–1 Apr. 1983, *Steyermark & Delascio 129242* (MO, NY, VEN not seen); cumbre, parte central de la montaña SE, 2,560 m, 10–12 Oct. 1983, *Steyermark et al. 129468* (MO, NY, VEN not seen); cumbre, parte central de la Mta. SE, 2,560 m, 10–12 Oct. 1983, *Steyermark et al. 129471* (MO, NY, VEN not seen); summit on undulating plateau, S & SE of summit camp, 2,520–2,650 m, 26–27 Feb. 1985, *Steyermark & Holst 130778A* (MO, NY); summit area, 2,750 m, early Feb. 1975, *Tillett et al. 752-344* (VEN: see Maguire et al., 1984).

Schefflera argophylla Frodin, sp. nov. TYPE: Venezuela. Bolívar: Sierra de Maigualida, NW sector, upper tributary of Caño Iguana, 2,000 m, 28 Feb.–3 Mar. 1991, *Berry et al. 4835* (holotype, MO; isotypes, MYF not seen, VEN not seen). Figure 1.

Arbor parva *Schefflerae contractae* arcte accedens, sed ab ea foliolorum venis primariis tenuioribus venis secundariis melius evolutis etiam apice caudato-acuminato differt. *S. guanayensem* simul referens at flores in hac in umbellulas dispositi.

Tree 3–4 m, with a sparse, broad crown (*fide* Huber); innovations initially pale silky pubescent but



Figures 1–4. —1 (Top left). *Schefflera argophylla* Frodin. *Huber 12764* (paratype, K). —2 (Top right), 3 (bottom left). *Schefflera asymmetrica* Frodin. *Stein & Gentry 1585* (holotype, K). —4 (Bottom right). *Schefflera baculosa* Frodin. *Huber 12860* (holotype, K).

twigs and other parts soon glabrous. Leaves digitately compound, 5–7-foliolate, the leaflets usually conduplicately folded; petioles 16–17.5 cm long, the base extending into an acute stipular ligule to 5 cm long; petiolules of unequal length, 1–5 cm long. Blades in a single plane, broadly elliptic to slightly obovate-elliptic, the widest point always somewhat above the middle, the lower part ± narrowed, 5–12.5 cm long, 3–7 cm wide, coriaceous; upper surface dark green, the under silvery-pale green, the contrast in younger leaflets being particularly strong; apex rounded, the tip acuminate to caudate-acuminate, base rounded to slightly cordate; midrib on undersurface conspicuous and contrasting; lateral veins numerous, the primary veins 12–14(–15) on a side, straight, spreading, closely spaced, extending to a marginal vein, in mature leaflets slightly raised from the mesophyll on the undersurface; secondary veins well developed. Inflorescences terminal, erect, twice compound, paniculate, dark purple when fresh and only further darkening when dry, the flowers in pedunculate heads, the axes and peduncles early thinly and conspicuously silky-pubescent but this later wearing off; main axis reduced; primary branches up to 5, mostly ascending to erect, 26–28 cm long, to 3 mm diam.; peduncles closely spaced, persisting in the upper ⅔ of each branch, 7–8 mm long; heads 9–12 mm diam.; flowers 10–15; stamens white; ovary 2-locular. Immature fruits green, 3 mm long, topped by an apically bifid stylar column 0.5 mm long; maturing fruits red.

Schefflera argophylla is most closely related to *S. contracta* from Cerro Jaua and *S. meiurophylla* from Cerro Uasadi. It differs from *S. contracta* by its finer leaflet venation (owing to the secondary veins being better developed) and the tips of the leaflets distinctly acuminate to caudate-acuminate. It differs from *S. meiurophylla* in the oblong-elliptic and usually conduplicately folded leaflets, with the bases rounded to slightly cordate. The three species appear to share a common ancestry, with their nearest relative being *S. jauaensis* Maguire, Steyermark & Frodin.

Schefflera argophylla is superficially similar to *S. guanayensis* Maguire, Steyermark & Frodin, but its leaflet blades are not as noticeably longer than the petiolules, the blades are flat and ± similarly colored on both surfaces, and the flowers are in umbellules.

The genus *Schefflera*, including this species, is a conspicuous element on the Sierra de Maigualida (Otto Huber, pers. comm.). *Schefflera argophylla* has been reported from borders of elfin forest and savanna, and in shrub patches or around rocks. The conduplication of the leaflets resembles that in *S. clausa*, as well as *S. pagiophylla* Harms from high in the mountains of western New Guinea. The specific epithet relates to the contrast between the leaflet surfaces, with the undersurface in particular somewhat silvery pale green.

Paratype. VENEZUELA. **Bolívar:** Sierra de Maigualida, sector NE, ca. 2,100 m, 28 Mar. 1988, *Huber 12764* (K, MYF not seen).

Schefflera asymmetrica Frodin, sp. nov. TYPE: Brazil [as "Venezuela"]. Amazonas: Cerro de la Neblina, ca. 3 km ENE of Pico Zuloaga, 1,900–2,000 m, 17 Apr. 1984, *Stein & Gentry 1585* (holotype, K; isotype, MO). Figures 2, 3.

Arbor *Scheffleram sessilifloram* simulans, sed ab ea foliolis pluribus angustioribus ad basin plus minusve asymmetricis, floribus in umbellula dispositis differt. *S. concolori* cognata, sed haec species a *S. asymmetrica* foliolis crassioribus ad basin symmetricis necnon in statu sicco colore paginae foliolorum discrepans. Foliola extima in *S. asymmetrica* ab medio in magnitudine valde disparans.

Tree 7–8 m, little-branched but with thick twigs; developing leaves initially densely pale tan pubescent but these soon glabrous as all other vegetative parts. Leaves digitately compound, 7–9-foliolate, the leaflets flat; petioles 29.5–65 cm long, drying light, the base extending into a stipular ligule to 1 cm long; petiolules 3–8.5 cm long. Blades in a single plane, narrowly oblong-lanceolate, falcate to oblique to symmetric, the widest point below the middle, 20–39 cm long, 5.2–13 cm wide, thinly coriaceous; surfaces dull, drying relatively light, both about the same color or nearly so; apex acute, the tip insensibly acuminate to caudate for up to 2 cm, base rounded to cordate, usually ± oblique, margins flat; midrib prominent on undersurface; lateral veins on each side 13–15 in addition to a basal vein, slightly conspicuous and about equally well expressed on both surfaces after drying, spreading-ascending, gradually curving before uniting with the marginal vein; cross-veins uneven but developing at an angle of approximately 90° to the midrib in mature leaflets; secondary venation partially developed, extending to about halfway to margin. Inflorescences terminal, erect, twice compound, paniculate, drying dark, the flowers in umbellules, the surfaces initially appressed-pubescent but this for the most part later wearing off except for the receptacle and ovary; primary branches few or apparently reduced to 1, stiff and stout, to 67 cm long and 9 mm diam. at the base; umbellules numerous, ca. 10–15-flowered, closely spaced along the branches, the peduncles

1.5–2.7 cm long. Flowers small, yellow; pedicels 5–6 mm long, each subtended by a minute lanceolate bracteole; corolla not seen; ovary obconic, 2-locular, 1.5–2 mm long, the disk flat, the stylar column as long as or longer, slender. Fruit remaining wholly inferior, 2-pyrenate, flattened, green when immature, 4–4.5 mm long, 3–3.5 mm wide; stylopodium 1.3–1.4 mm across; stylar column 2 mm long, the 2 elements just diverging at apex. Fruit not known.

Schefflera asymmetrica is apparently a tree of slopes below the main escarpments of the Neblina massif. It has distinctively narrow, basally asymmetric leaflets, to which the specific epithet refers. This species is most closely related to *S. concolor*, which also grows on the Neblina massif. Morphologically it is more specialized than *S. concolor*, and apart from the different leaflet shape and venation, has a fewer-branched inflorescence (which may even be reduced to a single branch). The paratype cited below was previously listed as a paratype of *Schefflera reticulata* subsp. *yutajensis* Maguire, Steyermark & Frodin (see Maguire et al., 1984: 59). *Schefflera maguireorum*, with which the earlier of the two available collections of *S. reticulata* subsp. *yutajensis* was formerly associated, is more distantly related, with smaller leaflets and pedicels only about 0.75 mm long.

Paratype. VENEZUELA. **Amazonas:** Cerro de la Neblina [N side], lower escarpment slopes E of Camp 3, 1,600 m, 24 Jan. 1954, *Maguire, Wurdack & Bunting 37379* (K, NY).

Schefflera baculosa Frodin, sp. nov. TYPE: Venezuela. Amazonas: Serranía Uasadi, sector NW, cumbres montañosas ubicadas en las cabeceras orientales del Río Asita, afluente derecho del Río Ventuari, 2,000 m, 22 Nov. 1988, *Huber 12860* (holotype, K; isotype, MYF not seen). Figure 4.

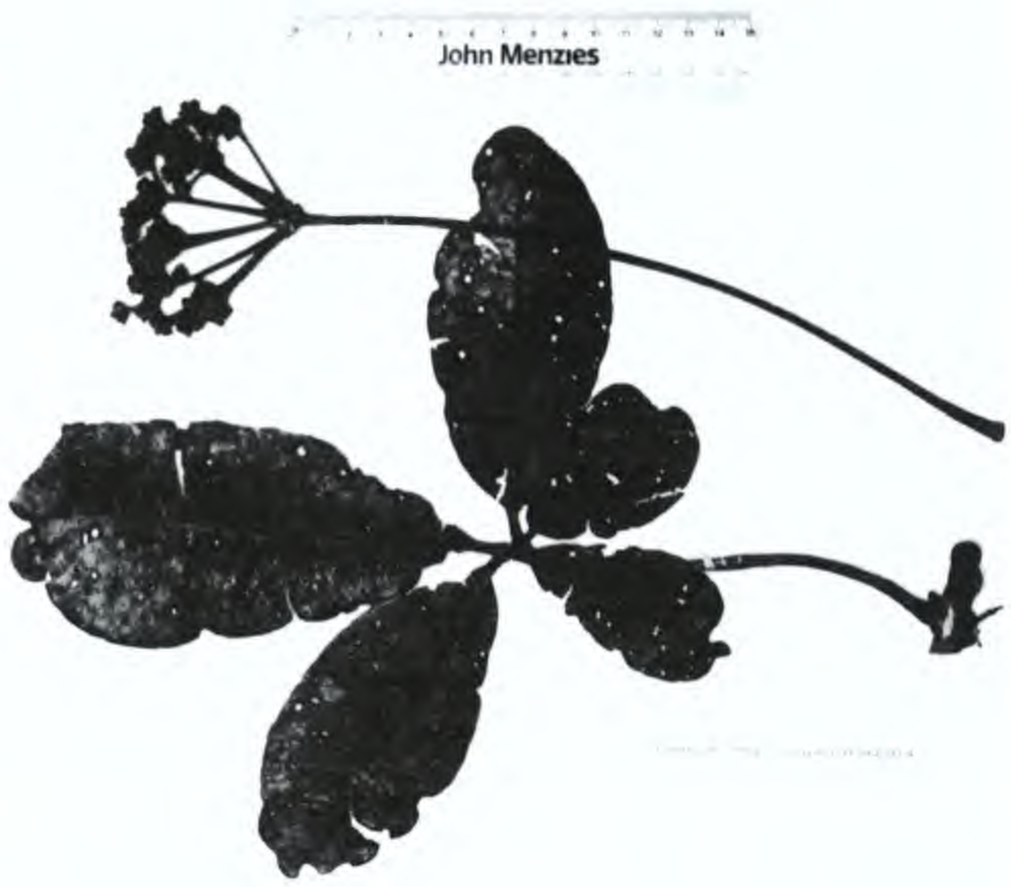
Arbor parva *Schefflerae ulocephalae* arcte affinis sed ab ea foliolis longioribus minus tomentosis vel fere glabrescentibus ad marginem non incurvatis etiam foliolis lateralibus subsessilibus recedit.

Shrub or tree 2–5 m tall, with flattened, dense crown; twigs 1 cm diam., dark-hairy. Leaves 3-foliolate; petioles about 12 cm long, arising from a broadened base with a free portion only 1–2 mm long; petiolules unequal, the central ones 1.9–2.1 cm long, the lateral ones 0.3–0.6 cm. Blades oblong-elliptic, glabrous and deep green above, undersurface shortly gray-tomentose (maroon-ferrugineous in young leaflets), extending over the venation, 11.9–13.5 cm long, 6.5–7.7 cm wide, coriaceous; apex rounded, tip flattened or slightly retuse, base rounded, symmetrical in central leaflets, oblique in the lateral, margins entire, flat when dry; upper surface somewhat rugose, venation and reticulum slightly recessed, undersurface with prominent, gradually fading midrib and somewhat raised venation; primary lateral veins 14–15 or more, spreading, curving slightly upward, ending in the largely consolidated marginal veins; secondary veins variously developed, ranging from about halfway toward the margin to the full distance; cross-veins not well developed, the reticulation irregular. Inflorescence initially terminal, later pseudolateral, umbellate, three times compound, the bracts persistent; main axis not developed; primary rays ca. 27.5 cm long, 5 mm diam., when dry dark tomentulose; secondary rays 2.7–3.3 cm long, radiating from the ends of primary rays and in a subsidiary whorl of 3 or 4 at some 2.7 cm below; ultimate coflorescences tertiary, with sessile central flowers at ends of secondary rays and (0)1 or 2 immediately adjacent lateral, tertiary, 6-flowered sessile clusters, the peduncles of the latter 1.1–1.5 cm long, brownish to dark tomentulose, the flowers each subtended by a minute bracteole; calyx rim 1 mm wide with 5 teeth; ovary 2- or 3-locular, 2 mm long, buff sericeous-tomentose, the stylar column about 2 mm long. Fruit green to purplish, compressed or angular, to 6 × 6 mm, remaining wholly inferior; stylar column 2 mm or so long, barely bifid or trifid at the apex.

Schefflera baculosa is in general most like *S. huberi*, but differs in its flattened margins, more spreading, less pronounced and finer venation, and more completely united styles in fruit, but most significantly in the sessile flowers. The trifoliolate leaves and sessile flowers resemble *S. ulocephala*, but that species has more pronounced pubescence, the leaflets have incurved margins, the heads (especially at anthesis) are tighter, and the stylar column is shorter.

Schefflera baculosa is one of a group of four closely related species (with *S. brachypoda*, *S. huberi*, and *S. longistyla*) that occur on Serranía Uasadi and nearby Serranía Maigualida. It is known only from the type collection and is reported to be frequent in low forest patches on sloping, rocky ground in summit areas on granite. These patches occur among herbaceous meadows.

Schefflera brachypoda Frodin, sp. nov. TYPE: Venezuela. Amazonas: Sierra de Maigualida, sector NE, altiplanicie tepuyana ubicada en las cabeceras del Río Chajura, afluente occidental del Río Erebato, aprox. 100 km (in línea recta) al SW del Campamento Entreríos, 2,100 m, 28 Mar. 1988, *Huber 12762* (holotype, K; isotype, MYF not seen). Figure 5.



Figures 5–8. —5 (Top left). *Schefflera brachypoda* Frodin. *Huber 12762* (holotype, K). —6 (Top right). *Schefflera chimantensis* subsp. *rugosifolia* var. *iluensis* Frodin. *Huber 12005* (holotype, K). —7 (Bottom left), 8 (bottom right). *Schefflera concolor* Frodin. *Gentry & Stein 46613* (holotype, K).

Arbor parva *Schefflerae ulocephalae* affinis; haec species nova foliis quinque-foliolatis, foliolis elliptico-obovatis etiam inflorescentiis radiorum secundariorum verticillos subsidario carentibus notabilis. Species itidem *S. longistylae* artissime cognata.

Shrub 2–3 m, the crown broad; twigs pithy, 0.9–1 cm across, the surfaces, including the leaf bases, finely tomentulose or glabrescent. Leaves 5-foliolate, the leaflets in a given leaf varying widely in size; petiole 14 cm long, the base broad, sheathing, with 2 distinct stipular lobes each to 5 mm; petiolules 0.3–1.2 cm long. Blades narrowly elliptic to oblong-obovate, glabrous above, light ferrugineous to grayish maroon-tomentulose beneath, 7.5–15.5(–16) cm long, 4–7.6 cm wide, rather coriaceous, the indumentum extending over the venation; apex rounded, tip absent, base broadly acute to obtuse, margins entire, flat, the lower part usually gradually tapering; upper surface slightly glossy, rugose, the venation and reticulum recessed; undersurface somewhat strongly veined, the midrib prominent, decreasing distally; primary and secondary lateral veins all but indistinguishable, in all 27 or 28 on each side, somewhat spreading, curving slightly upward before passing into a fairly well consolidated marginal vein formed from the anastomoses; secondary veins mostly extending to, or nearly to, the margin; cross-veins not regularly developed. Inflorescences initially terminal, later pseudolateral, umbellate, three to (occasionally) four times compound, at least the secondary bracts persistent; main axis not developed; primary rays ± 24 cm long, 3 mm diam., shortly ferrugineous-maroon-tomentose (along with all other reproductive parts), their number unknown; secondary rays about 10, 3.3–4.1 cm long, developing only at the ends of primary rays, subtended by bracts 4–5 mm long; ultimate coflorescences tertiary (occasionally in part developing to quaternary level), with a headlike cluster of central bisexual, fertile, almost sessile flowers at ends of secondary rays and usually 2 lateral, tertiary, ca. 6-flowered, headlike, almost sessile clusters arising immediately below, the peduncles of the latter 10–14 mm long, the flowers each subtended by a minute bracteole; calyx rim 0.5 mm wide, with 5 broad teeth; corolla and stamens greenish yellow, the petals opening from the top and spreading before falling; ovary (2-)3-locular, the disk 2–2.5 mm across after anthesis, the stylar column 1.5 mm long. Immature fruit to 4 × 4 mm, usually 3-angled when dry, heterochronous; stylar column 2 mm long, becoming distinctly trifid (or bifid) above, the arms about 0.5 mm long, curving outwards.

Distinguishing features of *Schefflera brachypoda* among related species are the 5-foliolate leaves, the rather unequally sized, narrowly elliptic to oblong-obovate, somewhat rugose leaflets, the short petiolules, and the almost sessile, mostly 3-carpellate flowers. The inflorescence resembles that of *S. ulocephala*, but differences include the presence of a minute pedicel, narrower calyx rim, a longer stylar column, and a somewhat larger disk; in addition, all the secondary rays are at the ends of the primary rays and the margins of the leaflets are incurved. In *S. ulocephala* there is also a subsidiary whorl of secondary rays, and the disks after anthesis are partly concealed by the calyx rim. A subsidiary whorl also distinguishes *S. baculosa*, which has 3-foliolate leaves with longer-petioluled leaflets and sessile flowers and fruits. The presence of fourth-order umbellules resembles *S. pallens*, but the more repand inflorescences with longer secondary rays (especially those in the subsidiary whorls) and the distinctive whitish indumentum on the undersurface of the leaflets readily distinguish that species.

Schefflera brachypoda is known only from the type collection and is part of the highland tepui vegetation on a plateau in northeastern Sierra de Maigualida, where it is frequent in shrub communities and low forest. So far it has not been found together with *S. huberi* and *S. longistyla*, which have both been collected from the northwestern sector of the same massif but at a lower altitude.

Schefflera chimantensis (Steyermark & Maguire) Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 81. 1984. Basionym: *Didymopanax chimantensis* Steyermark & Maguire, Mem. New York Bot. Gard. 17: 456. 1967. TYPE: Venezuela. Bolívar: Chimantá massif, on slope leading to summit of Apacará-tepui, 2,000–2,150 m, 20 June 1953, *Steyermark 75788* (holotype, NY; isotype, F).

Further study of this and *Schefflera rugosifolia* Maguire, Steyermark & Frodin (*Didymopanax rugosus* N. E. Brown) suggests that only one species is involved, particularly if the plants initially assigned to *Didymopanax multiramosus* Steyermark (Steyermark, 1967) and later merged with *Schefflera chimantensis* (Maguire et al., 1984) are considered in greater detail. More material is presently available than was so during my initial studies in 1969 and 1970, and a wide range of the tepuis in the Gran Sabana uplands are now represented (all within the eastern tepui subdivision; see Huber, 1988: 598, 602). Nevertheless, the differences upon which the original taxa were based can be correlated with distribution and habitat, and a further distinction has been noted between the plants of the Roraima and Ilú groups of tepuis.

The scheme presented here calls for recognition of each of the three original taxa as subspecies, with one, *S. rugosifolia*, further divided into two varieties. Some redeterminations of material cited in 1984 under *S. chimantensis* and *S. rugosifolia* have been made, and are so indicated below. A key to the infraspecific taxa of *S. chimantensis* will appear soon in the *Flora of the Venezuelan Guayana*.

Schefflera chimantensis subsp. **chimantensis**

This subspecies is known only from the Chimantá massif and nearby Angasima-tepui.

Specimens examined. VENEZUELA. **Bolivar:** Macizo del Chimantá, Amurí-tepuy (sector W del Acopán-tepuy), ± 1,850 m, 2–5 Feb. 1983, *Huber & Steyermark 7110* (MO); en la sección SE del Apacará-tepui, ± 2,150 m, 6–9 Feb. 1984, *Huber, Collela & Vareschi 8890* (NY); Macizo del Chimantá, sector sur-occidental, cumbre meridional del Amurí-tepui, ± 2,100 m, 10–14 Mar. 1986, *Huber 11401* (CM, NY); cumbre occidental del Angasi ("Adanta")-tepui, 40 km WNW of Wonken, ± 2,100 m, 9 Aug. 1986, *Huber 11690* (K); Macizo del Chimantá, sector sur-oriental, Churí-tepui, sección centro-suroriental, ± 2,250 m, 6–8 Feb. 1985, *Pipoly et al. 7145* (MO, NY); Macizo del Chimantá, Amurí-tepuy (sector W del Acopán-tepuy), ± 2,200 m, Jan.–Feb. 1983, *Steyermark et al. 128316* (MO); Macizo del Chimantá, sector N; altiplanicie, Apacará-tepui, ± 2,200 m, Jan.–Feb. 1983, *Steyermark et al. 128364* (MO, NY); Macizo del Chimantá, Amurí-tepui (sector W del Acopán), ± 1,850 m, 2–5 Feb. 1983, *Steyermark et al. 128475* (MO, NY); Macizo del Chimantá, Amuri-tepui, sector W del Acopán-tepui, ± 1,850 m, 2–5 Feb. 1983, *Steyermark et al. 128770* (MO); central section of Chimantá massif, Río Tirica, 2,120 m, 12 Feb. 1955, *Steyermark & Wurdack 782* (F, NY).

Schefflera chimantensis subsp. **multiramosa** (Steyermark) Frodin, comb. et stat. nov. Basionym: *Didymopanax multiramosus* Steyermark, Acta Bot. Venez. 2(5–8): 273. 1967, not *Schefflera multiramosa* Elmer, 1914. TYPE: Venezuela. Bolívar: Auyán-tepui, in quebrada below El Libertador, cumbre de la parte S, 2,050–2,300 m, 15 May 1964, *Steyermark 93926* (holotype, VEN not seen; isotype, NY).

This subspecies is known from Auyán-tepui, the Aparamán Range of tepuis to the east (also known as "Los Testigos" and including from west to east Aparamán-tepui, Murisipán-tepui, Tereké-Yuren-tepui, and Kamarkaibaray[or Camarcaibarai]-tepui), Ptari-tepui, and the Chimantá massif.

Additional specimens examined. Venezuela. **Bolívar:** Kamarkaibaray-tepui, al E del Auyán-tepui, 2,400–2,500 m, 25 Mar. 1987, *Delascio 13138* (MO); Murisipán-tepui, summit, 2,300 m, 22 Mar. 1987, *Holst 3524* (MO); Camarcaibarai-tepui, summit, 2,400 m, 26 Mar. 1987, *Holst 3618* (MO); Aparamán-tepui, summit, 2,100 m, Mar. 1987, *Holst 3660* (MO); cumbre del Kamarcawarai-tepui, 2,350 m, 15 Jan. 1986, *Huber & Gorzula 11105* (NY); cumbre del Kamarcawarai-tepui, 2,350 m, 15 Jan. 1986, *Huber & Gorzula 11113* (NY); Ptari-tepui (al N de la Misión de S. Teresita de Kavanayén), cumbre, 2,360–2,420 m, 23 Feb. 1978, *Steyermark et al. 115695* (NY, VEN not seen); cumbre de Auyántepuy, en zanjones, 2,150 m, 3 Feb. 1988, *Delascio & Lopez 13638* (MO); Macizo del Chimantá, Murey(Eruoda)-tepui, cumbre, 2,500 m, 24 Feb. 1978, *Steyermark et al. 115753* (MO, VEN not seen); Aprada-tepui, cumbre, 2,460–2,500 m, 25 Feb. 1978, *Steyermark et al. 115935* (MO, VEN not seen; number miscited as *115753* in Maguire et al. 1984); altiplanicie meridional del Abacapá-tepui, en SW del Macizo del Chimantá, ± 2,200 m, Jan.–Feb. 1984, *Huber & Dezzeo 8640* (MO, NY); cumbre del Aprada-tepui, sector S ubicado ca. 30 km al E de Urimán, 2,500 m, 30 June 1984, *Huber 9542* (NY); Chimantá massif, Churí-tepui, upper part of upper cumbre, 2,300–2,350 m, 3 Feb. 1953, *Wurdack 34309* (K, NY).

Schefflera chimantensis subsp. **rugosifolia** (Maguire, Steyermark & Frodin) Frodin, comb. et stat. nov. Basionym: *Didymopanax rugosus* N. E. Brown [as "rugosum"], Trans. Linn. Soc. ser. 2, Bot. 6: 31. 1901, not *Schefflera rugosa* Harms, 1894. *Schefflera rugosifolia* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 71. 1984. TYPE: Venezuela [as "Guyana"], Mt. Roraima, 8,600 ft., Oct. 1898, *McConnell & Quelch 663* (lectotype, selected by Maguire et al. (1984), K).

The subspecies *rugosifolia* is known only from the eastern tepui chain, including Ilú-and Tramen-tepui, Yuruaní-tepui, Kukenán-tepui, Roraima-tepui, and Karaurín-(or Caraurín-)tepui.

Schefflera chimantensis subsp. **rugosifolia** var. **iluensis** Frodin, var. nov. TYPE: Venezuela. Bolívar: ladera SW del Caraurín-tepui, ± 1,950 m, 21 Feb. 1987, *Huber 12005* (holotype, K; isotype, MYF not seen). Figure 6.

A var. *rugosifolia* foliis 3–5-foliolatis foliolisque lateralibus externis distincte petiolulatis recedit.

Variety *iluensis* differs from the nominate variety in having (3-)4-or 5-foliolate leaflets with the petioles of the lateral leaflets distinctly developed. In variety *rugosifolia* the leaves are mostly 3-foliolate (rarely 4-foliolate), and the petioles of the lateral leaflets are generally almost obsolete.

Additional specimens examined. VENEZUELA. **Bolívar:** Ilú-tepui, cumbre, sector central-meridional, 2,630 m, 29 Apr. 1984, *Huber 9500* (NY); cumbre del Tramen-tepui (porción más NW del Macizo de Ilú-tepui), 2,650 m, 23 Jan. 1985, *Huber 10051* (NY); cumbre surooccidental del Ilú-tepui, 2,700 m, 18 June 1985, *Huber & Alarcón 10599* (CM, NY); cumbre del Caraurín-tepui,

al S del Ilú-tepui, ± 2,450 m, 21 Feb. 1987, *Huber 12023* (K, MYF not seen); Ilú-tepui, saddle between North Peak and Central Plateau, 2,400 m, 15 Mar. 1952, *Maguire 33425* (K, NY).

Schefflera chimantensis subsp. **rugosifolia** var. **rugosifolia**

Additional specimens examined. GUYANA. Mt. Roraima, 6,500–7,000 ft., 26 Mar. 1978, *Peter J. Edwards KER.128* (K). VENEZUELA. **Bolívar:** Mt. Roraima, summit area, 2,750–2,800 m, 26 Aug.–2 Sep. 1976, *Delascio & Brewer-Carías 4812* (VEN, cited by Maguire et al., 1984); cima del Roraima, 2,810 m, Sep. 1982, *Delascio & Clemants 11883* (MO); cumbre del Yuruaní-tepui, ± 12 km NNE del Kukenán-tepui, 2,200 m, 29 Feb. 1984, *Huber 9093* (MO, NY); Kukenán(Matauí)-tepui, cumbre meridional cerca de la punta S del tepui, 2,700 m, 15 June 1985, *Huber & Alarcón 10545* (NY); Yuruaní-tepui, cumbre oriental, 2,300 m, 8 Sep. 1986, *Huber 11812* (K, MYF not seen); Mt. Roraima, 7,600 ft., 31 Oct. 1973, *Persaud 132* (K, NY); cima del Roraima-tepui, cerca del camino de ascenso, 2,500 m, 4 May 1986, *Picón-Nava 1125* (K); Mt. Roraima, summit area, NW portion, N & NW of Summit Camp, 2,620–2,740 m, 27 Sep. 1944, *Steyermark 58824* (NY); Mt. Roraima, summit area, 2,750–2,800 m, 26 Aug.–2 Sep. 1976, *Steyermark et al. 112444* (NY); Mt. Roraima, summit, 2,850 m, Oct. 1927, *Luetzelberg 21568* (M); Mt. Roraima, summit, 24 Nov. 1927, *Tate 370* (NY); Mt. Roraima, "auf dem Gipfel," ca. 2,700 m, Dec. 1909, *Ule 8705* (G, K, L); Auyán-tepui, cumbre, sector suroriental, 2,140 m, 26 Feb. 1978, *Steyermark et al. 116047* (MO, VEN not seen).

Schefflera clausa Frodin, sp. nov. TYPE: Venezuela. Bolívar: Meseta de Jaua, Cerro Jaua, cumbre, S part, 2,000 m, 27 Feb. 1974, *Steyermark, Carreño & Brewer-Carías 109629* (holotype, K; isotypes, MO, NY, US, VEN not seen).

Arbor parva *Scheffleram crassilimbam* referens, sed haec species nova petiolulis brevibus (0.3–)0.6–2.0 cm longis, foliolorum 8–10 venis ad paginam infernam vix elevatis, inflorescentiis tri-vel quadriramosis umbellulisque 7–9-floris notata. Ab *S. guayanensi* petiolulis brevioribus necnon foliolorum pauciorum costis marginibusque purpureis differt.

Tree 2.5–5 m, glabrous except for inflorescences and their basal bracts; stems pithy, 9 cm thick below apex. Leaves digitately compound, 8–10-foliolate, the leaflets usually conduplicately folded; petioles (4.5–)10–20 cm long, drying dark brown to red-brown, the base extending into a stipular ligule 0.5–0.6 cm long; petiolules (0.3–)0.6–2 cm long. Blades in a single plane, narrowly elliptic to oblanceolate to oblong-elliptic to elliptic-oblanceolate, about 12 cm long, 3.5 cm wide, relatively coriaceous; surfaces dull, somewhat contrasting, the lower pale olive when dry (when fresh deep green above, pale green to silvery below); apex acute, passing into an acuminate or shortly caudate tip, base shortly and abruptly rounded, margins flat; midrib and marginal vein purplish, sharply contrasting with mesophyll but not markedly raised below; lateral veins on each side 13–16, ± parallel, spreading, extending to and joining the marginal veins, not contrasting with and only barely raised above mesophyll below, paler than mesophyll above; secondary lateral veins and reticulation obscure, not contrasting. Inflorescences terminal, twice compound, paniculate, drying dark, the flowers in umbellules, the surfaces pubescent; primary branches 3 or 4, 33–60 cm long, divaricately spreading, glabrescent after anthesis, the basal bracts broadly lanceolate, 1 cm long; umbellules ca. 40–60, ca. 7–9-flowered, closely spaced along the upper ¾ of branches, the peduncles 0.6–1.5 cm long. Flowers small, ca. 2.5 mm long in bud, the calyx rim at or below middle, the ovary and pedicels pale to olive green; pedicels at anthesis very slender, 3–6 mm long; calyx rim scariose, thrust outwardly after anthesis, wavy with 5 small teeth; corolla greenish yellow, splitting from the apex into 5 petals, these spreading before falling; filaments greenish yellow or greenish white; anthers yellow; ovary after anthesis 2.5 mm long, obconic, the disk flat and topped by a stylar column ca. 2 mm long, this divaricating at top into two stigmatic arms. Fruit pale flesh with pale green (as once reported), wholly inferior, appearing flattened, 5 mm long, 7 mm across, the calyx rim persistent, the stylar column with spreading stigmatic arms each 0.5 mm long.

Schefflera clausa is a distinctive species within the "Cheilodromi" group. The paratypes cited below were previously associated by Maguire et al. (1984) with *Schefflera guanayensis* Maguire, Steyermark & Frodin subsp. *guanayensis* and with *Schefflera guanayensis* subsp. *paruensis* Maguire, Steyermark & Frodin (now treated as a distinct species, *S. paruana*). *Schefflera clausa* differs from *S. guanayensis* in having fewer, often conduplicately folded leaflets, petiolules that are shorter and more congested, less prominent veins on the undersurface, longer pedicels, and, after anthesis, a more uniformly slender stylar column. The midrib and marginal vein may also be markedly purplish, thus contrasting with the pale mesophyll of the blades.

From *Schefflera pedicelligera* of Cerro Duida *S. clausa* differs in having more, somewhat smaller, and differently shaped leaflets (which are relatively pale when dry and usually conduplicate), 3 or 4 primary inflorescence branches with, on average, more umbellules along each, and considerably longer peduncles. Other species in which the leaflets show

conduplicate folding are *S. argophylla* and *S. contracta;* both of these, however, have the flowers in heads.

Schefflera clausa is confined to the Meseta de Jaua mountain complex. It is thus the most easterly among the members of its series in which the flowers are distinctly umbellulate. It is known to occur in dwarf forest in gullies or at the edge of meadows in summit areas.

Additional specimens examined. VENEZUELA. **Bolívar:** Meseta de Jaua, Cerro Sarisariñama, cumbre, porción NE, 1,380 m, 11–12 Feb. 1974, *Steyermark, Carreño & Brewer-Carías 108965* (K, NY, VEN not seen); Cerro Guanacoco, cumbre, porción NW, 1,450 m, 3 Mar. 1974, *Steyermark, Carreño & Brewer-Carías 109752* (K, NY, VEN not seen).

Schefflera clavigera Frodin, sp. nov. TYPE: Venezuela. Bolívar: Ptari-tepui, slopes and rocks in vicinity of "Cave Rock Camp" below S face, 1,600–2,000 m, 14–19 Aug. 1970, *H. E. Moore, Jr. et al. 9767* (holotype, NY; isotypes, BH, DAV, MICH, MO, UC, US, VEN not seen). Figure 10.

Arbor parva vel modice altior aliquantum *Schefflerae umbellatae* similis sed per paginas supernas foliolorum in statu sicco laeves, venas in paginis inferioribus patentes atque parum claras, internas satis parallelas, stylos 3–4 mm longos in 1 mm apicali liberos, et ovarium bi-vel triloculare recedit.

Shrub, treelet, or small to medium-sized tree 1.5–7(–12) m, the trunk with a diameter to 7.5 cm (or possibly more). Leaves (3)4–8(9)-foliolate (possibly also unifoliolate in very young plants); petioles 12–22.5 cm long, the clasping bases to 1.6 cm across but not extending into a distinct stipular ligule; petiolules stout, 0.5–2.5(–3) cm long, not varying greatly within a given leaf. Blades narrowly obovate to obovate to slightly oblong-obovate, glabrous and usually ± glossy and smooth-looking above, finely and densely appressed silvery-sericeous or buff-hairy below, (7–)9–14(–15.5) cm long, (2.5–)3.4–8(–8.5) cm wide, rather coriaceous; apex broadly obtuse to shallowly emarginate, the tip absent or very short, base cuneate to obtuse, smoothly decurrent into petiolule, margin uniform, ± incurved; midrib relatively dark, prominent and strongly raised below; primary and other lateral veins many, closely parallel, spreading at an angle of 60°–70° to the midrib, usually relatively inconspicuous, somewhat divaricating toward margin and looping and anastomosing at some 2 mm distant from it. Inflorescences morphologically terminal (but by maturity appearing somewhat pseudolateral), compound-umbellate, of stout aspect; primary rays 3–5, the axes gray to gray-green when fresh but generally drying dark, glabrescent during maturation, (21–)24–39 cm long, to 8 mm diam. toward base, sometimes featuring a glaucous bloom but without a subsidiary whorl or whorls of secondary rays (except in *Steyermark 93924*, see below); secondary rays 13–25 or more, also stout, all apical, 2–4.5 cm long, spreading to erect, crowded together and, with the succeeding axes and flowers, appearing clublike; secondary bracts deciduous; ultimate coflorescences tertiary (except in *Pipoly et al. 7251*, see below), diadochogamous (successive unions), entirely terminal, the central pedicels ca. 3–4 mm long, subtended usually by 2 pedunculate umbellules; outer peduncles (tertiary rays) of these lateral umbellules 1–1.1 cm long, bearing fourth-order pedicels about 3 mm long. Flowers congested; corolla yellow-green, petals and stamens 5; filaments green to creamy, anthers yellow; ovary green, 2- or 3-locular, the styles green, 3–4 mm long, free from one another in the last 1 mm. Maturing fruits wholly inferior, initially green; body to 5 × 5 mm, surmounted by a constricted calyx rim with its free portion ca. 1.5 mm wide and bearing 5 small teeth; stylar column ca. 3.5–4 mm long, sometimes with 2 but more often with 3 ± spreading branches at top.

The first collection of this plant was made by Julian Steyermark on Ptari-tepui in 1944; he determined it and one subsequent gathering from nearby Carrao-tepui as *Schefflera umbellata* (Steyermark, 1957), apparently accepting a large range in leaflet number. This determination was maintained for a later record from Auyán-tepui (Steyermark, 1967). Although in 1969 or 1970 I suggested these plants might be a distinct species, Steyermark did not accept this, noting "I do not see separable differences between these specimens and the others cited under *S. umbellata*, and regard [these plants] as conspecific with *S. umbellata*" (from my notes on the present species; copy in NY). I have chosen *Moore et al. 9767* as the type because it is widely distributed among herbaria and it originates from the same tepui as the earliest known record, *Steyermark 59745*.

Since the end of the 1960s, many more collections of *S. clavigera* and *S. umbellata* have been made, and the differences I originally perceived have largely held. In *S. clavigera*, the leaflets are more distinctly obovate (vs. widest closer to the middle of the leaflets in *S. umbellata*, with a more pronounced apex), their upper surfaces have a smoother appearance when dry (vs. ± sunken in *S. umbellata*), and the venation on the undersurface is generally finer and less conspicuous with the subsidiary ve-

nation more distinctly parallel, while the fruits have only 2 or 3 pyrenes (vs. 3–5) and a longer stylar column to 4 mm long (vs. 2.5–3 mm) with free portions to 1 mm (vs. barely 3–5-fid at the apex).

Steyermark (1967: 275–277) amply summarized the differences that *Schefflera umbellata* and the then included *S. clavigera* show with the related *S. coriacea*. The relationship, though, is surely more distant than between the sister species of *S. clavigera* and *S. umbellata*.

Schefflera clavigera is variable most evidently in leaflet number, the indumentum, and the degree of expression of the lateral veins on the undersurface of the leaflets and the amount of gloss above. Nevertheless, plants are usually readily distinguishable from *S. umbellata*. No correlations among character states have been detected that might be congruent with geographical differences within the species' range. *Pipoly et al. 7251*, however, has an extra reiteration in the ultimate coflorescences, with the central array of flowers at the fourth order and the subtending side peduncles bearing fifth-order umbellules of male or hermaphroditic flowers (comparable to *S. auyantepuiensis*). Also, *Steyermark 93924* has a more finely sericeous indumentum, indistinct veins, and, most notably, primary inflorescence rays each with one subsidiary whorl of secondary rays; this last feature was also noted by Steyermark (1967).

Schefflera clavigera is a sometimes common inhabitant of tepui forest and scrub, where it is associated with *Bonnetia roraimae* and *B. steyermarkii*, apparently most often occurring on lower-lying ground, sometimes along creeks in swales as well as on lower slopes. It is not known yet whether it is less common on Auyán-tepui than on the Chimantá massif, but on Auyán-tepui the presence of the similar-looking *S. auyantepuiensis* (an endemic species there) in comparable habitats should be accounted for. The two species were once collected at nearly the same time and place (*Steyermark 116010*, *S. clavigera*, and *Steyermark 116020*, *S. auyantepuiensis*, both at 2,140 m in the southeastern part of the plateau).

Paratypes. VENEZUELA. **Bolívar:** Auyán-tepui, 2,500 m, Jan. 1949, *Cardona 2685* (US, VEN not seen); Auyán-tepui, near quebrada of "Boggy Camp" below El Libertador, 2,050–2,300 m, 15 May 1964, *Steyermark 93924* (NY, VEN not seen); Auyán-tepui, cumbre, sector sur-oriental, 2,140 m, 26 Feb. 1978, *Steyermark et al. 116010* (MO, VEN not seen); Auyán-tepui, summit area, 2,300 m, Apr. 1956, *Vareschi & Foldats 4836* (NY, VEN not seen); Camarcaibarai-tepui, 2,300 m, 26 Mar. 1987, *Holst 3634* (MO); Camarcaibarai-tepui, SW-facing shoulder, 1,800–1,825 m, 22–24 May 1986, *Steyermark, Liesner & Holst 132024* (MO, NY, VEN not seen); Tereké-Yuren-tepui, summit, W edge, ± 2,100 m, 26 May 1986, *Liesner, Steyermark & Holst 21120* (MO); cumbre del Kamarcawarai-tepui, 2,350 m, 15 Jan. 1986, *Huber & Gorzula 11097* (MO, NY); Carrao-tepui, 2,470–2,500 m, 7 Dec. 1944, *Steyermark 60904* (F, US); Ptari-tepui, SW-facing shoulder, 2,000–2,200 m, 2 Nov. 1944, *Steyermark 59745* (F, NY); Chimantá massif, Abácapa-tepui, NW part, 2,125–2,300 m, 13 Apr. 1953, *Steyermark 74897* (F, NY); Abácapa-tepui, E-central portion of summit, in deep fissures, 2,120 m, 11 Feb. 1955, *Steyermark & Wurdack 716* (F, NY); base N de los farallones superiores del Amurí-tepui, Chimantá, 1,950 m, 2–5 Feb. 1983, *Steyermark et al. 128613* (MO, US, VEN not seen); Amurí-tepui, Macizo de Chimantá, ± 2,100 m, 4–6 Mar. 1986, *Huber 11414* (CM, MYF not seen, NY); Cerro Apacará, 2,100 m, 8 July 1946, *Cardona 1580* (US, VEN not seen); sector SE del Apacará-tepui, Macizo de Chimantá, ± 2,150 m, 6–9 Feb. 1984, *Huber et al. 8824* (MO, NY, VEN not seen); Apacará-tepui, Macizo del Chimantá, ± 2,150 m, 6–9 Feb. 1984, *Huber et al. 8887* (MO, MYF not seen, NY, US); Apacará-tepui, sector C-N, ± 2,150 m, 11–14 Mar. 1986, *Huber 11545* (MO, MYF not seen, NY); Apacará-tepui, above SE-facing upper shoulder on slope going to summit, 2,000–2,150 m, 20 June 1953, *Steyermark 75802* (F, MO, NY); Apacará-tepui, E-central portion of summit, in deep fissures, 2,450–2,500 m, 21–22 June 1953, *Steyermark 75890* (F, NY); Apacará-tepui, sector N del Macizo de Chimantá, altiplanicie, ± 2,200 m, 28 Jan. 1983, *Steyermark et al. 128317* (MO, VEN not seen); Apacará-tepui, sector N del Macizo de Chimantá, altiplanicie, 2,200 m, 28 Jan. 1983, *Steyermark et al. 128314* (MO, VEN not seen); Churí-tepui, in lower part of lower W cumbre, 2,100–2,200 m, 24 Jan. 1953, *Wurdack 34196* (K, NY); Macizo de Chimantá, sector centro-meridional, ± 2,100 m, Feb. 1985, *Pipoly et al. 7251* (MO, NY, US); Macizo de Chimantá, sector centro-NE del tepui, ± 2,000 m, 26–29 Jan. 1983, *Steyermark 128160* (MO, VEN not seen); Macizo de Chimantá, sector centro-NE del tepui, ± 2,250 m, 26–29 Jan. 1983, *Steyermark et al. 128059* (MO, NY, US, VEN not seen); Macizo de Chimantá, sector E del tepui, ± 2,200 m, 7–9 Feb. 1983, *Steyermark et al. 128986* (MO, US, VEN not seen).

Schefflera clusietorum Frodin, sp. nov. TYPE: Venezuela. Amazonas: Cerro de la Neblina, Río Yatúa, in "moss forest" 2–3 km S of Camp 3 [on N slopes of the massif], 700–800 m, 26 Dec. 1953, *Maguire, Wurdack & Bunting 36904* (holotype, K; isotype, NY).

Arbor procera *Scheffleram japurensem* simulans, sed ab ea paginis infernis foliolorum in tempore minus sericeis atque venis lateralibus subobscuris magis patulis (ad angulam 75° ad 80°), inflorescentiarum internodiis supremis radiorum secundariorum 5–12 mm longis differt. Species bella sed ut videtur localissima.

Tree 6–12 m tall; twigs appressed-hairy, 0.7–0.8 mm diam. Leaves usually 7-foliolate. Blades narrowly elliptic or oblong-elliptic, the surfaces when dry not strongly contrasting, 7.2–16 cm long, 2.4–6.5 cm wide, somewhat coriaceous; apex obtuse or

slightly emarginate, the tip absent, base obtuse, margins somewhat narrowly wavy, unbroken; upper surface glabrous; undersurface finely and inconspicuously hairy, but not distinctly sericeous; midrib conspicuous on both surfaces, though distinctly raised only below; primary lateral veins about 15, spreading at an angle of 70°–80° to the midrib, not impressed when dry on the upper surface, barely raised and rather inconspicuous below; secondary lateral veins always parallel to the primary veins and as inconspicuous. Inflorescence terminal, compound-umbellate; primary rays 4, glabrous or sparsely hairy, 28–36 cm long, without a subsidiary whorl of secondary rays; secondary rays all apical, 9–11, 4.5–6.4 cm long; ultimate coflorescences diadochogamous, comprising a central umbellule at the end of the rays and 2 pedunculate lateral umbellules emerging opposite one another and 0.5–1.2 cm below the ray ends, the whole dully sericeous. Buds pale green; flowers otherwise as *S. japurensis*.

Schefflera clusietorum is most closely related to *S. japurensis*, with which it was included by Maguire et al. (1984). It can be distinguished from that species by the leaflet shape (here more oblong and lacking a tip, the apex being quite obtuse or emarginate), the smooth, uniform upper surface and (at maturity) less sericeous undersurfaces, the angle of the lateral veins (here at 75°–80° to the midrib, as opposed to 70° or less in *S. japurensis*) and their inconspicuousness on the undersurface (usually in *S. japurensis* they are distinct, contrasting with the mesophyll and slightly raised), and, in the ultimate coflorescences, the upper internode on the secondary rays is 0.5–1.2 cm (in *S. japurensis*, 0–0.6 cm). The upper surface of the leaflets is dull, especially when compared with the glossy surface usually seen in *S. japurensis*.

Schefflera clusietorum is known only from the type collection, made in a *Clusia* "moss forest." The existence on the Neblina massif of what seems to be a possibly derived sister species of the widely ranging *S. japurensis*, which lacks other immediate relatives, lends support to the idea that it is the richest of all the Guayana massifs (J. Wurdack, pers. comm.). *Schefflera japurensis* has also been collected there at comparable altitudes, once in Cañon Grande and once on Serra Pirapucú just to the south of Neblina in Brazil.

Schefflera concolor Frodin, sp. nov. TYPE: Brazil [as "Venezuela"]. Amazonas: Cerro Neblina, Pico Phelps, S face, steep cliffs, 1,550–1,650 m, 13 Apr. 1984, *Gentry & Stein 46613* (holotype, K; isotypes, MO, US). Figures 7, 8.

Arbor *Schefflerae sessiliflorae* non dispar, sed haec species nova petiolulis brevioribus (tantum ad 45 mm longis), venis lateralibus conspicuioribus, et floribus umbellatis notabilis. A *S. asymmetrica* foliolorum apice magis abrupte acuminato, lamina concinna crassioreque, et venis lateralibus strictioribus differt.

Tree 10 m, the twigs thick. Leaves digitately compound, 6- or 7-foliolate, the leaflets flat; petiole 28 cm long, 5 mm diam. near base, drying relatively dark, glabrous or with a very few scattered appressed hairs, the base extending into a well-developed stipular ligule to 2 cm long; petiolules 2.6–4.5 cm long. Blades in a single plane, oblong-elliptic, symmetrical, broadest point near the middle, 19–21 cm long, 6.4–7.8 cm wide, stiff when dry, coriaceous; surfaces drying relatively light, both about the same color or nearly so, the upper surface slightly shining, the underside slightly glossy; apex acute to subobtuse, the tip abruptly acuminate or shortly caudate, 0.7–1 cm long, base subtruncate and somewhat cordate, margins wavy in two planes; midrib relatively prominent below, drying somewhat darker than the mesophyll; lateral veins 11–14 on a side in addition to a basal vein, moderately conspicuous, more distinctly raised on the undersurface than the upper when dry, moderately diverging, relatively straight or slightly curving up toward margin before uniting with the marginal vein; subsidiary lateral venation irregularly developed, soon giving way to ± parallel cross-venation oriented almost perpendicularly to the midrib, at an angle of 100° or so in mature leaflets. Inflorescences presumably terminal, twice compound, paniculate, drying dark, the flowers in umbellules; main axis apparently scarcely developed; primary branches probably about 6–8, stiff and stout, diverging, 45–56 cm long, 4–5 mm diam. near base, each subtended by lanceolate basal bracts to 2 cm long; umbellules ca. 60–80 in the upper ¾ of each branch, ca. 20–24-flowered, almost headlike, closely spaced, the peduncles comparatively slender, finely appressed-hairy, 1.4–2 cm long, each subtended by an inconspicuous bract 1.5–2 mm long. Flowers small, congested, green; pedicels slender, 2.5–3 mm long; after anthesis ovary externally appressed-hairy, 0.6–0.7 mm long, the stylopodium about 0.3 mm diam., topped by an apparently undivided stylar column 0.9–1 mm long; locules 2. Fruit not known.

Schefflera concolor is most closely related to *S. asymmetrica*, also growing on the Neblina massif. From that species it differs most evidently in having thicker, symmetrical leaflets with more contrasting surfaces, an apex with a more abruptly formed tip, and straighter, more robust primary lateral veins;

the inflorescence is characterized by shorter pedicels, more flowers in each umbellule and (possibly) more primary branches. Somewhat more distant may be *S. pedicelligera*, but in that species the leaflets are smaller and the flushes have a more lax, open aspect, particularly evident in the inflorescence.

Both *Schefflera concolor* and *S. asymmetrica* share several character states with a range of species in a wide variety of lineages. The basic architecture of leaf and inflorescence is similar to that of *S. morototoni*, but in that species the venation and indumentum details are quite different and the inflorescence is usually fewer-branched and three times compound. The paniculate inflorescence with long branches radiating from a very short main axis and bearing racemosely arranged umbellules is widespread, also occurring in the Old World; but a species such as *S. oblonga* Craib (Thailand, Peninsular Malaysia) has leaflets with very different venation and partially superior fruits. The unique leaflet character for *S. asymmetrica* and the majority of other species with twice compound paniculate/racemose inflorescences is the marginal vein to which all lateral veins join without (or nearly without) curving.

An examination of the maps in Brewer-Carías (1988) suggests that *Gentry & Stein 46613*, the only known collection of the species, although labeled as from Venezuela was obtained just south of the Venezuelan–Brazilian border, which passes along the southern rim of the massif and over Pico Phelps. The habitat was described as a "bromeliad zone on steep cliffs," which implies at least a partially open situation. At 1,550–1,600 m, it was collected somewhat below the presently known average altitude for *S. asymmetrica*.

Schefflera contracta Frodin, sp. nov. TYPE: Venezuela. Bolívar: Cerro Jaua, cumbre in west-central part of meseta, 1,922–2,000 m, 22–27 Mar. 1967, *Steyermark 97978* (holotype, NY; isotype, VEN not seen).

Arbor parva *Schefflerae jauaensi* arcte cognata, sed ab ea foliis et ramis inflorescentiae et capitulis omnis minoribus recedit; *S. argophyllae* foliolorum dimensionibus similis. *S. guanayensem* itidem in facie referens at in hac flores in umbellulas dispositi.

Tree 8 m tall. Leaves 6- or 7-foliolate; petiole glabrous, fairly stout, originally dull purplish maroon, dark when dry, ca. 17.5 cm long, the base extending into a stipular ligule 1.5–2 cm long, ± thickly silvery-lanuginose when young; petiolules 1.2–4 cm long, thick, appearing short in relation to the blades. Blades ± oblong-elliptic, usually widest near the middle, very stiff and hard, dark green above, silvery or pale green below when fresh, comparable in size to *S. argophylla* and as in that species apparently ± conduplicately folded in life, glabrous except for a tomentose indumentum on the undersurfaces of young leaflets; apex obtuse to rounded, the tip abruptly and very shortly acuminate, base usually cordate, margins unbroken or nearly so, flat; upper surface when dry ± shining, dark, the veins not very conspicuous; lower surface paler, the midrib very prominent but the lateral veins rather less marked; primary lateral veins 12–17 or more on each side, spreading, extending ± straight to the marginal vein; secondary veins variously developed but usually extending ½–⅔ way to margin, followed usually by 1 cross-vein oriented at right angles to the midrib. Inflorescences apparently similar to *S. argophylla*, axes and peduncles dull purplish maroon when live; primary branches relatively slender, ca. 10 cm long, glabrous except for silvery-lanuginose hairs toward the base, bearing racemosely arranged capitula in the upper ⅗; peduncles glabrescent, 7–9 mm long, subtended by bracts 2 mm long; capitula ca. 5 mm across, 10–12-flowered; calyx rim narrow, 5-toothed; ovary 2-locular, the disk flat; styles in immature fruit < 0.5 mm long, partly united.

Schefflera contracta was originally identified as *S. jauaensis* (as *S. reticulata* subsp. *jauaensis*), but it can be distinguished from that species by its smaller leaves and inflorescences and fewer-flowered heads. Until recently the basic combination of character states represented was known only from the one collection; however, within the last five years additional collections have been made that show it to be part of a superspecies, or monophyletic alliance, with members from the Serranía Uasadi (*S. meiurophylla*) and the Sierra de Maigualida (*S. argophylla*). *Schefflera contracta* is more closely related to them than it is to *S. jauaensis*. It differs from *S. meiurophylla* mainly in the conduplicately folded oblong-elliptic leaflets. Its venation and reticulation are, on the other hand, more comparable with it than *S. argophylla*. As for *S. argophylla*, the differences with *S. contracta* are chiefly in the leaflet shape, apex, and venation; here the secondary lateral veins are less well developed and the leaf tips hardly expressed. Also, the leaflets show less contrast when dry.

Schefflera coriacea (Marchal) Harms, in Engler & Prantl, Nat. Pflanzenfam. III 8: 37. 1894. TYPE: Venezuela. Bolívar: Mt. Roraima, *Im Thurn 128* (holotype, K).

Oreopanax coriaceus J. Decaisne & Planchon, cited in the synonymy of *Schefflera coriacea* in Maguire et al. (1984), refers not to the present species but to a true *Oreopanax* from Colombia represented by *Triana 190* (Seemann, 1865). The type of *Schefflera coriacea* subsp. *neblinae* Maguire, Steyermark & Frodin is, in addition to being geographically remote from the range of the nominate taxon, sufficiently distinct to merit specific rank. The plant is renamed later in this paper as *Schefflera neblinae*. The list of specimens cited under *S. coriacea* in Maguire et al. (1984) should also exclude *Steyermark 90225*, which is *S. japurensis*.

Schefflera cracens Frodin, sp. nov. TYPE: Venezuela. Bolívar: Ilú-tepui (Gran Sabana), ridge E of Mesa Grande, 1,650 m, 9 Mar. 1952, *Maguire 33323* (holotype, K; isotypes, NY, VEN not seen). Figure 9.

Arbuscula praeruptorum montanorum *Schefflerae monospermae* arcte cognata sed ab ea foliolis ad apicem acutis, inflorescentiis diffusioribus, radiis secundariis posterior 3–8.2 cm longis et pedicellis umbellularum ultimarum 15–18 mm longis differt.

Shrub or tree 2–4 m, of sparse habit, glabrous throughout but in some cases glaucous; twigs ca. 4 mm diam. when dry, emitting a strong odor on cutting. Leaves mainly trifoliolate (occasionally unifoliolate or 4- or 5-foliolate), the leaflets flat; petiole 4.6–7 cm long, slender, rather sulcate when dry; stipular ligule at base reduced; petiolules 0.6–1.9 cm long. Blades in a single plane, elliptic, 3.8–7 cm long, 1.2–2.1 cm wide, thinly coriaceous, not or but slightly contrasting when dry; surfaces ± shiny above, probably slightly shiny below; apex acute, recurving slightly into a somewhat bluntly acuminate tip, base acute, decurrent, margin shortly inrolled; midrib alone slightly raised on the undersurface, paler than the mesophyll; main veins ca. 9 or 10 on a side, ascending, fairly straight, extending to margin with some once bifurcating, more clearly visible above than below; secondary veins well developed and almost indistinguishable from the primary veins. Inflorescence pseudolateral, the base bypassed by the continuation shoot, all the axes, peduncles, and pedicels reddish maroon; primary rays 4, 16–17 cm long, elegantly curving upward; secondary rays ca. 12–13, 3–8.2 cm long, extending in all directions; ultimate coflorescences umbellate, diadochogamous, the 4–6 inner rays merely pedicellate, 8–18 mm long, the outer one or (usually) two pedunculate, of similar length, bearing quaternary umbellules with 5 or 6 very slender pedicels 7–9 mm long. Buds 2 mm long. Calyx rim about 1 mm diam.; corolla glabrous, 1 mm long, the apex shortly beaked, the petals separating from above and spreading before falling; stamens creamy white; ovary 1 mm long, widening slightly below the calyx rim, pseudomonomerous. Fruit similar to *S. monosperma*, wholly inferior, flattened, light green, oblique, developing only on one side, 4.5 mm long, 2.5–3 mm wide (up to 5 mm when fresh), the rim not increasing in width; stylar column slender, lax, 0.8 mm or so long.

Maguire et al. (1984) first suggested that among material then assigned to *Schefflera monosperma* two species might be represented. Further collections, including an additional record from Caraurín-tepui, have strengthened the case for this argument. Following reexamination of the type of *S. monosperma*, I here describe the Ilú plant and Caraurín plant as a new species. *Schefflera cracens* differs from *S. monosperma* in the more lax inflorescences, with longer secondary rays and pedicels, and in the leaflet apices being acute rather than obtuse or emarginate. The secondary rays are 3–8.2 cm long, the pedicels 8–18 mm long; in *S. monosperma* the corresponding units are 2–5 cm and 5–10 mm. There is also a tendency for *S. cracens* to be trifoliolate, whereas in *S. monosperma* the leaves are usually 5-foliolate. Still, the two species appear to be very closely related; like the African pair *S. umbellifera* (O. W. Sonder) Baillon and *S. lukwangulensis* (Tennant) Bernardi, a case could be made for treating them as a single "collective species." The centers of the two taxa are distant from one another by about 50 km.

Schefflera cracens grows as a sparse-looking tree or shrub in low tepui woodland or forest on ridges or "shoulders" or upper slopes. Associated genera include *Clusia*, *Oedematopus*, and *Magnolia*.

Paratype. VENEZUELA. **Bolívar:** Caraurín-tepui, ladera SW, ± 1,950 m, 1 Feb. 1987, *Huber & Picón 11982* (K, MYF not seen).

Schefflera crassilimba Frodin, nom. et stat. nov. Replaced name: *Schefflera guanayensis* subsp. *sipapoensis* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 67. 1984. TYPE: Venezuela. Amazonas: Cerro Sipapo (Paráque), Phelps Camp to North Savanna, 1,400 m, 17 Dec. 1948, *Maguire & Politi 27756* (holotype, NY; isotypes, K, MO).

Tree to 15 m tall with a trunk to 12 cm DBH, but usually smaller; twigs ca. 1 cm thick. Leaves digitately compound, 7–10-foliolate, the leaflets flat; petioles 13–25 cm long; petiolules of unequal length,

Figures 9, 10. —9 (Left). *Schefflera cracens* Frodin. *Maguire 33323* (isotype, VEN). Habit with detail of fruit. —10 (Right). *Schefflera clavigera* Frodin. Habit with detail of fruit.

0.5–5.5 cm. Blades on a single plane, oblong-oblanceolate, 9–16.5 cm long, 3–7 cm wide, flat, quite coriaceous, drying ± light olive-brown, the surfaces not notably contrasting; apex usually broadly obtuse or rounded, the tip generally quite short to almost obsolete, base cuneate to obtuse, not or very slightly decurrent into the petiolule, margin not or but slightly recurved, unbroken; midrib somewhat raised below; lateral veins about 10–12 on each side, obscure to just visible above, very slightly raised below,

spreading-ascending and generally straight, extending to margin and intersecting with the marginal vein, not contrasting with mesophyll below when dry; secondary veins ± developed; fine reticulation just visible when dry; marginal vein rather fine, obscured by the margin. Inflorescences terminal, twice compound, paniculate, the flowers in shortly pedicellate umbellules; main axis 5 cm long, proliferating over its entire length; primary branches 10–12, 30–34 cm long, somewhat stout, ± ascending in all directions; peduncles quite slender, numerous, racemosely arranged along most of branch length, 10–30 mm long, with very small persistent bracts at base. Flowers small; pedicels to 2 mm long; ovary after anthesis 2 mm long, bearing a slender stylar column to 2 mm long. Maturing fruit distinctly elongate, sometimes developing slightly obliquely, the body to 6 × 2.5 mm, the calyx rim conspicuous, 1 mm wide, erect; stylar column to 2 mm long, bifid at apex, the tips spreading; pedicels to 4 mm long.

Previously described as a subspecies of *Schefflera guanayensis*, this plant is sufficiently distinct from others treated under that species to merit specific rank. The leaflet color (when dry) and texture, leaf bases, and the small tip and the less conspicuous lateral and marginal veins distinguish it from what are now *S. guanayensis* and *S. paruana*. It can be differentiated from *S. guanayensis* by the prevailing leaflet shape; from *S. paruana* it differs in the leaflet texture, color, smaller size, and unbroken margins, the last feature also serving to separate it from *S. pedicelligera*. The elongate fruits are also distinctive.

Schefflera crassilimba is limited to the upper parts of Cerro Sipapo, where it appears to inhabit lower slopes and valleys, sometimes occurring along streams. Its closest relative seems to be *S. guanayensis*, which occurs approximately 130 km to the northeast. Cerro Sipapo, the most westerly of the high Guayana tepuis, is also home to three other distinctive endemics: *S. sipapoensis* Maguire, Steyermark & Frodin, *S. pauciradiata* Maguire, Steyermark & Frodin, and *S. myrioneura* Frodin (the latter described below).

Additional specimens examined. VENEZUELA. **Amazonas:** Cerro Cuao, Caño Cabeza de Manteco, 73 km SE de Puerto Ayacucho, 1,580 m, 5°06′N, 67°28′W, Sep. 1989, *A. Fernández et al. 6262* (MO, PORT not seen); Caño Piedra, 115 km al SE de Puerto Ayacucho, 1,500 m, 4°54′N, 66°54′W, Sep. 1989, *A. Fernández et al. 6022* (MO, PORT not seen); Cerro Sipapo (Paráque), occasional in East Basin, 5,000–5,500 ft., 20 Jan. 1949, *Maguire & Politi 28470* (NY, VEN not seen); Cerro Sipapo, S branch, Caño Profundo, via Caño Negro, 1,400 m, 8 Jan. 1949, *Maguire & Politi 28251* (K, NY).

Schefflera disparifolia Frodin, sp. nov. TYPE: Venezuela. Bolívar: Mukuripá-tepui (5°15′N, 60°53′30″W), 1,300 m, 6 Sep. 1986, *L. Hernández 434* (holotype, K). Figure 11.

Arbor *Schefflerae umbellatae* laxe affinis, ab ea inflorescentiae ramis primariis tenuoiribus, ramis secundariis paucioribus (ad 13–14), 5–7 cm longis; paginis inferis foliolorum fulvo-sericeis. Folia composita simplicesque coaetanea ferit.

Tree 12 m tall; twigs 9 mm diam. Leaves 6-foliolate, but sometimes unifoliolate just below the inflorescence; petiole 15–19 cm long, 2.5 mm diam., the sheathing base as broad as the twig but not pulling away from it when dry and without a ligular lobe; petiolules (where present) slender, 0.8–2 cm long. Blade in simple leaves oblong-ovate, glabrous above, bright and finely sericeous-hairy below, 18 × 10.5 cm, coriaceous, brittle; apex not known, base broadly obtuse; venation spreading, somewhat raised beneath, the lateral veins numerous, ending in a semi-consolidated submarginal vein. Blades in compound leaves narrowly elliptic to slightly obovate, 9–12 cm long, 3.5–4.6 cm wide, thinly coriaceous; apex just obtuse, tip scarcely evident, base broadly acute, margins entire, incurved, their lower parts gradually curving; upper surface drying olive-green, the veins and reticulum very slightly recessed; undersurface finely veined, the veins and reticulum rather faint. Inflorescence initially terminal, umbellate, basically twice compound but some ultimate coflorescences once reiterated, the axes drying olive green, most bracts fugacious; main axis not developed; primary rays about 3, 17–17.5 cm long, 4 mm diam., thinly sericeous; secondary rays about 13 or 14, all at ends of primary rays, 5–7 cm long, ± pale-sericeous; ultimate coflorescences umbellate, with a central cluster of 15–17 flowers on pedicels 6–8 mm long and 1–3 lateral umbellules emerging beside or just below the cluster, the latter with brightly sericeous peduncles 13–16 mm long and 5–10 probably unisexual flowers on pedicels (perhaps not fully developed in the available material) ca. 2 mm long. Buds described as white but perhaps greenish with a bright sericeous indumentum; flowers later yellowish green. Immature fruit remaining wholly inferior, oblong, usually 3-angled when dry, 3–4 mm long; calyx rim 1 mm wide, with 5 small teeth; disk 2 mm across; stylar column about 1.5 mm long, becoming slightly trifid at apex with advancing development.

Schefflera disparifolia differs from *S. umbellata*, found at higher elevations in the nearby Roraima-Ilú-tepui complex, in the finer venation of the leaflets, the mostly fugacious bracts, the persistence of

Figures 11–14. —11 (Top left). *Schefflera disparifolia* Frodin. *L. Hernández 434* (holotype, K). —12 (Top right). *Schefflera dissidens* Frodin. *Liesner 23329* (holotype, K). —13 (Bottom left). *Schefflera eximia* Frodin. *Boom et al. 5969* (holotype, K). —14 (Bottom right). *Schefflera huberi* Frodin. *Huber 12701* (holotype, K).

indumentum on inflorescence axes (particularly the secondary rays) during fruit maturation, the generally shorter secondary rays, the longer pedicels, the more marked distinction of the fruit from the pedicel, and the styles evidently remaining mostly united during fruit maturation. The ovary evidently is always trilocular. Elsewhere in the Guayana, the leaflets recall *S. clavigera*, but in that species the primary rays of the umbel are stouter and the stylar column in fruit is longer. The umbels, as well as the leaflets and presence of a trilocular, somewhat oblong ovary, superficially resemble *S. huachamacarii* Maguire, Steyermark & Frodin, but in that species the leaflets are smaller and the primary rays always have a naked, or empty, node; nevertheless, it is possibly the most closely related species and occurs at middle to upper-middle altitudes.

More material is needed to determine whether the reversion of the leaves to a unifoliolate state just below the inflorescence is common or peculiar to the material cited here. Further collecting in the area is also desirable, both because this plant comes from an intermediate altitude—a level that I believe has been somewhat neglected, but which has yielded such interesting species as *S. clusietorum*, *S. nigrescens*, *S. neblinae* and *S. varisiana*, and in the "Didymopanax" group, *S. yutajensis*—and because there may be a local radiation of the *S. umbellata* line, especially on what seem to be lower-altitude summit areas. A related, possibly distinct plant from a nearby tepui, at an elevation similar to that of Mukuripá-tepui, is represented by another collection from Lionel Hernández: Matawaí-tepuy, oeste tepuy [Kukenán-tepui] (5°12′N, 60°53′W), 1,500 m, 6 Sep. 1986, *L. Hernández 430* (MO); due to incomplete material, however, it is not being described at this time.

Schefflera dissidens Frodin, sp. nov. TYPE: Guyana. Mazaruni–Potaro: Mt. Roraima, summit area just E of Venezuelan border, La Proa Camp near Lake Gladys, 2,800 m, 14 Apr. 1988, *Liesner 23329* (holotype, K; isotype, MO). Figure 12.

Arbor parva paludicola *Scheffleram acaropunctatam* referens, sed ab ea inflorescentiae ramis secundariis longitudine duas exhibentibus atque nodum et absque nodo intermedium, carentibus recedit. Umbellae secundariae conjunctim clavis non similes, *S. umbellatae* conversae.

Tree 2 m tall; twigs rapidly thickening below current shoot, > 1.5 cm diam., the current shoot(s) to about 0.8 cm. Leaves 4–6-foliolate, the base extending across the twig, sheathing, blunt above with no significant free portion; petiolules 1–2.8 cm long. Blades elliptic, glabrous, green and somewhat shiny above, darkly glaucous and minutely pubescent to glabrescent below (brightly sericeous-pubescent in young growth), 6.3–10 cm long, 3–6(–6.7) cm wide, stiff, coriaceous; apex rounded, the tip absent or retuse, base obtuse to rounded, ± decurrent into the petiolule, margins entire, slightly incurved when dry, curving ± uniformly; surfaces relatively smooth, the veins and reticulum above very slightly recessed when dry, ± slightly but distinctly raised below; midrib beneath prominent, ± glaucous; primary veins 11 or 12, slender, spreading-ascending, gently rising, sometimes divaricating, abruptly curving and anastomosing just inside margin to form an inframarginal vein; secondary veins variously developed, some extending almost to margin; reticulation fairly fine, lacking in organized crossveins. Inflorescence initially terminal, later pseudolateral, umbellate, basically twice compound (but some coflorescences with lateral single reiterations), the axes largely glabrescent, drying relatively dark; main axis absent; primary rays 1 (or perhaps 2), stout-looking, 24 cm long, 5.5 mm diam.; secondary rays all terminal, 1.5–6 cm long, essentially of two lengths; ultimate coflorescences umbellate, comprising, if fully manifest, a central cluster of 6–10 or more bisexual, fertile flowers subtended by one or more umbellules of probably unisexual (male) flowers (evidently mostly absent or undeveloped or abortive in the material studied), the peduncle 0.8 cm long, sericeous-pubescent; ovary usually 3- or 4-locular. Maturing fruit gray-green, 3- or 4-angled, globose, about 5 × 5 mm; calyx rim about 1 mm wide, wall-like, the teeth relatively obscure; disk < 2 mm across, recessed; stylar column ca. 3 mm long, 3- or 4-fid at apex, the arms radiating at right angles, about 0.5 mm long.

Schefflera dissidens is superficially similar to the apparently sympatric *S. umbellata*, but differs from it in the leaves having less strongly marked venation and margins not evidently incurved or revolute, inflorescences with 1(2) branch(es) and secondary rays of widely varying lengths with the longest exceeding those in *S. umbellata*, and fruits 3- or 4-angled. In *S. umbellata* the secondary rays are mostly of similar length. The morphology of the leaflets also resembles *S. acaropunctata*, but in that species the leaflets are generally smaller and the inflorescence branches rather shorter; it usually also has one empty node.

Schefflera dissidens is known only from the type collection and occurs on the summit of Mt. Roraima in open rocky areas with ravines and a small lake.

Schefflera duidae Steyermark, Fieldiana, Bot. 28: 444. 1952.

Contrary to Maguire et al. (1984), I believe that *Schefflera quinquestylorum* should retain specific rank. The arguments are presented under that species. *Schefflera duidae* subsp. *duidae* then becomes a plant with an extensive range in the western Guayana, extending also to Serra Aracá in northern Brazil (Prance et al., 1992). *Schefflera duidae* is a shrub or small tree, 5–6 m tall, or a liana. It is found along streams or on forested sandstone ledges or declivities, at 1,250–1,800 m in Estado Bolívar (Sierra Pacaraima, Cerro Sarisariñama) and Estado Amazonas (Cerro Cuao, Cerro Duida, Cerro Huachamacari, Cerro Neblina, Sierra Parima) in Venezuela, and northwestern Amazonian Brazil (Cerro Neblina, Serra Pirapucú, Serra Surucucus).

Schefflera eximia Frodin, sp. nov. TYPE: Brazil. Amazonas: Serra da Neblina [S rim], Camp 12 [in the headwaters of the Rio Ariobó drainage, 2 km SW of Pico da Neblina], 1,950 m, 26–27 Feb. 1985, *Boom, Buck & Brewer-Carías 5969* (holotype, K; isotype, NY). Figure 13.

Arbor parva montium nebulosorum *Schefflerae coriaceae* affinis, at ab ea per folia minor elliptica etiam inflorescentias semel compositas statim diagnoscenda. Pericarpium fructus in statu sicco ut videtur non sulcatum sed tantum rugosum.

Tree 4 m tall, 12 cm diam.; twigs glabrous, ca. 8 mm across below apex, thickening gradually. Leaves 5- or 6-foliolate; petioles 16.5–22 cm long, base sheathing, not or only slightly pulling away from stem on drying, the free portion scarcely developed; petiolules 1–5 cm long. Blades narrowly oblong-elliptic, glabrous above, rather finely puberulent below, 11–15 cm long, 5–6.2 cm wide, coriaceous; apex tapering, shortly rounded, the tip retuse, base obtuse to rounded, margin flat or slightly incurved; upper surface fairly glossy, drying olive green, the veins and reticulum slightly recessed; undersurface initially rusty hairy, later turning patchily gray, somewhat veiny, the midrib strongly expressed; primary lateral veins 10–13 on each side, somewhat differentiated from the secondary veins, ascending, sometimes divaricating, gradually curving and merging into a consolidated marginal vein; secondary veins partially to almost completely developed; reticulum faintly expressed, in dry state more readily discernable above. Inflorescence terminal, umbellate, once compound, bracts fugacious; primary rays about 7, unbroken, glabrous, 15–17 cm long, 2.5 mm diam., drying dark; coflorescences simply umbellate, 20–25-flowered, the pedicels 18–21 mm long, ± finely rusty sericeous; flowers not known. Fruit remaining inferior, globose, green before maturity, to 7 × 7 mm, 5-angled when dry; calyx rim narrow, with 5 shallow teeth; disk about 3 mm across; stylar column 3 mm long, only the stigmata slightly discrete.

Schefflera eximia is without apparent immediate relatives; outstanding features include the once compound umbellate inflorescence, comparable to those in the Plerandra group in the western Pacific, and, among species of the Guayana Highland, the relatively large, five-pyrenate fruits. The fine, rusty indumentum on younger leaflets is also distinctive. Somewhat coarse leaflet venation and five-pyrened fruits are also seen in *S. coriacea* and *S. japurensis;* in the former, the primary rays of the inflorescence each have a subsidiary verticil of secondary rays, while in the latter the styles are free. *Schefflera gracillima* Steyermark & Maguire has 4- or 5-locular fruits, but in that species the leaves are smaller and the inflorescence much more delicate.

The type collection contains another, possibly extraneous element: a twice umbellate inflorescence of about 6 primary rays 17–18 cm long, each with a naked intermediate node and about 25 terminal secondary rays or peduncles 3.7–4.5 cm long; on each of the latter are 10–12 fruits similar to but smaller than those described in the protologue, with the end of the stylar column a little more divided. No leaves are attached. The spread and proportions of the secondary rays and the naked nodes recall *S. huachamacarii* Maguire, Steyermark & Frodin, but in that species the fruits are 3-pyrened and the leaf has 3–5 leaflets.

Schefflera eximia is known only from the type collection and is described as occurring in *Bonnetia*-dominated scrub forest. This is part of the tepui vegetation formation (Huber & Alarcón, 1988). Camp 12 was situated by a waterlogged savanna, but the environs, close to Pico da Neblina, also included a thick, stunted, heavily mossed cloud forest (Brewer-Carías, 1988: 150).

Schefflera guanayensis Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 66. 1984. TYPE: Venezuela. Amazonas: Cerro Guanay [summit area], 1,800 m, 2 Feb. 1951, *Maguire et al. 31740* (holotype, NY).

The original description of *S. guanayensis* contained elements of what are now *S. clausa*, *S. crassilimba*, and *S. paruana*. The brief description of the nominate subspecies is likewise drawn from discordant elements; the cited paratype, *Steyermark et al. 108965*, is *S. clausa*. A revised description,

which incorporates one collection made since 1984, is accordingly presented below.

Treelet or small tree 2–5 m, glabrous except for thinly appressed hairs on inflorescence axes and peduncles; twigs relatively thick and pithy, 1.1 cm diam. below the apex. Leaves 10–12-foliolate; petioles 13–27 cm, drying dark brown, the base extending into a stipular ligule for ca. 1 cm long and widening below; petiolules unequal, 1.2–5 cm. Blades in a single plane, flattened, green above, pale green below, oblong to oblong-ovate to elliptic-ovate, the widest point at or somewhat above middle, 6–12 cm long, 3–6.7 cm wide, coriaceous; surfaces somewhat glossy above, dull below, somewhat contrasting when dry but not markedly so; apex obtuse, tip acuminate or (in leaves from younger trees) shortly caudate, base broadly obtuse to subrotund, margins flat, unbroken; midrib somewhat prominent beneath; primary lateral veins ca. 10–14, not sharply contrasting with mesophyll when dry except for being paler on the upper surface, spreading-ascending, extending to and intersecting with margin, hardly curving but partially breaking up distally into percurrent tertiary cross-veins; secondary lateral veins divergent at a higher angle, partially developed, weakening into the reticulation. Inflorescences terminal, twice compound, paniculate, drying dark, the flowers in umbellules; primary branches up to 6, 20–27.5 cm long, 3 mm diam. near base, ascending to almost erect, thinly to sparsely appressed-hairy, basal bracts lanceolate, ca. 1.1 cm long; peduncles 28–50, scattered, slender, 0.9–3 cm long, their subtending bracts 2.5–3 mm long; umbellules ca. 10-flowered or so, pedicels about 2 mm long, the basal bracteoles 1 each, reduced or early caducous. Stamens 5. Immature ovary 2.5–3 mm long; disk gently sloping, then sharply curving into a stylar column 2 mm long, bifid at the apex, the stigmata ± spreading; calyx almost entirely adnate, the rim nearly flush with disk, with 5 small acute lobes. Fruit not seen, but probably remaining entirely inferior.

Among related species, *Schefflera guanayensis* sensu stricto has no readily discernable features, except perhaps the comparatively small, fairly closely veined leaflets with unbroken margins and the slightly tapering partial panicles. Only *S. crassilimba* and *S. clausa* share this combination of relatively small leaflets and flowers in umbellules. *Schefflera crassilimba*, previously described as *S. guanayensis* subsp. *sipapoensis* Maguire, Steyermark & Frodin, may be distinguished by somewhat thicker, relatively narrower leaflets with ± narrowed bases, less contrast between the leaflet surfaces when dry, and somewhat longer inflorescence branches. *Schefflera clausa* has a more slender appearance, foliage drying pale with distinctive purplish margins, and usually conduplicately folded leaflets. In addition, *S. crassilimba* is usually on lower slopes and in valleys, whereas *S. guanayensis* is found in more exposed situations, comparable to those of *S. clausa*.

Small leaflets are also found in *S. argophylla*, *S. contracta*, and *S. meiurophylla*, but all these have their flowers in heads. The somewhat larger-foliaged but also umbelluliferous *S. maguireorum* (*S. reticulata* subsp. *yutajensis*) has leaflets with coarser-looking venation and flowers almost in heads, the pedicels being only ca. 0.75 mm long. *Schefflera paruana*, formerly associated with *S. guanayensis*, has indented margins like those in *S. pedicelligera* Maguire, Steyermark & Frodin, and as presently known cannot be confused with the Cerro Guanay plants.

The relatively thick twigs of this species resemble two other umbelluliferous species, both of the Neblina massif: *S. asymmetrica* and *S. concolor*. These, however, have larger, differently veined leaflets and longer inflorescence branches and pedicels; moreover, the peduncles are not as widely ranging in length, thus causing the partial panicles to be less tapering. Also, the twigs of *S. concolor* are as much as 2.5 cm across when dry.

Schefflera guanayensis inhabits scrub and dwarf forests in the summit area and on ridges. This is comparable to the situation of *S. clausa*. The only other known ridge and summit dwellers are the very distinct *S. tremuloidea* and *S. marahuacensis*.

Additional specimen examined. VENEZUELA. **Amazonas:** Serranía Guanay, sector NE, toward Río Parguaza, ± 1,700 m, 20–28 Oct. 1985, *Huber 11059* (MO, MYF not seen, NY).

Schefflera huberi Frodin, sp. nov. TYPE: Venezuela. Amazonas: Sierra de Maigualida, sector nor-occidental, cabeceras del Río Iguana, afluente del Río Asita, 1,720 m, 25 Mar. 1988, *Huber 12701* (holotype, K; isotype, MYF not seen). Figure 14.

Arbor parva *Schefflerae ulocephalae* affinis, sed ab ea foliolorum venis lateralibus modice ascendentibus et ovariis brevissime pedicellatis differt. Folia interdum 4-foliolata foliolis pagina infera minus tomentosa.

Tree 5–7 m, with broad, dense crown; twigs pithy, 1.4 cm across, the surfaces, including the leaf bases, brown pubescent. Leaves 3- or 4-foliolate; petiole 13.5–16 cm long, the base broad, sheathing, with a free portion to 3 mm long; petiolules 0.9–2.4 cm long. Blades oblong-elliptic, dark green and glabrous above, dark grayish maroon and tomentulose be-

neath, 9.2–15.4 cm long, 3.8–8.1 cm wide, coriaceous; apex rounded, tip absent, base broadly acute to rounded, margins entire, distinctly incurved; upper surface somewhat glossy, moderately rugose, the venation recessed; undersurface strongly veined, the midrib prominent, decreasing distally; primary lateral veins 11–15, spreading-ascending, gently curving upward before passing into a semi-consolidated marginal vein formed from the anastomoses; secondary veins almost as strongly developed; crossveins few to several on each side but variously oriented and passing only between primary and secondary veins. Inflorescences initially terminal, later pseudolateral, umbellate, three times compound, at least the secondary bracts persistent; main axis not developed; primary rays ca. 26.5 cm long, 4 mm diam., glabrescent, drying dark, their number unknown but presumably not more than 5 or 6; secondary rays 2.3–3.5 cm long, dark-tomentulose, radiating hemispherically at ends of primary rays and outwards in a subsidiary pseudowhorl of 6 at ca. 6 cm below, subtended by bracts 4–5 mm long; ultimate coflorescences tertiary, with a cluster of central bisexual, fertile flowers on pedicels 2 mm long at ends of secondary rays and (0)1 or 2 lateral, tertiary, ca. 7-flowered umbellules arising immediately below, the peduncles and pedicels of the latter respectively 8–12 mm and 2–3 mm long, tomentulose, the pedicels each subtended by a minute bracteole; calyx rim 1 mm wide, 5-toothed; ovary obconic, 1 mm long, the disk flat, the stylar column 2.5–3 mm long, the tip bifid or trifid. Immature fruit 4–5 mm long, bright green, 4 mm across, compressed or 3-angled when dry, hardly heterochronous.

Among related species, *S. huberi* has the strongest-looking venation and the least consolidated marginal veins. It shares primarily trifoliolate leaves with *S. baculosa* and *S. ulocephala*, but differs from the latter in the flowers being pedicellate and the leaflets having thinner pubescence and more ascending venation; in addition, the stylar column is distinctly longer. From the former it differs in the leaflet margins being incurved when dry, the undersurface more finely tomentulose with coarser, more strongly expressed and ascending venation, more slender primary inflorescence rays, and pedicellate flowers.

Schefflera huberi is known only from the type collection and is reported as being of sparse occurrence in scrub vegetation of upper headwaters, at least some of it reported as secondary. Associated species may include *S. longistyla*, of similar habit and aspect, and the more readily distinguishable *S. umbraculifera*.

Paratypes. VENEZUELA. **Amazonas:** Sierra Maigualida, NW sector, small valley along upper tributary of Caño Iguana, 2,000 m, 28 Feb.–3 Mar. 1991, *Berry et al. 4833* (MO).

Schefflera japurensis (Martius & Zuccarini ex E. Marchal) Harms, in Engler & Prantl, Nat. Pflanzenfam., III 8: 38. 1894; Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 71. 1984. TYPE: Colombia. Caquetá: Araracoara, Japura River, *Martius s.n.* (holotype, M).

This is one of the two most widely distributed species in the "Crepinella" group, though seemingly relatively scattered in occurrence. Knowledge of its range remains imperfect. Since 1984 it has been collected in two parts of Peru: Dept. San Martín, Rioja Province, logging road to N of Carretera Marginal (km 431), 56 km W of Rioja, 2 km E of Naranjos, 980 m, 1 June 1986, *Knapp et al. 7445* (MO); Dept. Huánuco, Pachitea Province, W part of Sira Mountains, above "Campamento Pato Rojo," 1,200 m, 22 Dec. 1987, *Wallnöfer 17-221287* (K, WU not seen), and 1,300 m, 23 Dec. 1987, *Wallnöfer 12-231287* (K, WU not seen). These are ca. 700–1,000 km southwest and south of the southern edge of the Guayana Shield, where the otherwise most westerly record occurs (Araracuara on Río Caquetá, southeastern Colombia). The several southeastern Colombian records are in turn distinctly separated geographically from those in or near the Neblina massif, cited below. In addition, *Cardona 1765* (US; see below) extends the range into the Gran Sabana uplands.

Changes to the list of exsiccatae presented in Maguire et al. (1984) are also necessary, due to redeterminations. *Steyermark 90225* belongs here, not under *S. coriacea; Cardona 1765* likewise belongs here and not under *S. umbellata;* and *Maguire et al. 36904* is a distinct species, *S. clusietorum.* In Brazil, *Fróes 12638* likewise is distinct; it will be described elsewhere.

Known Venezuelan records now include: **Bolívar:** Río Caroní, Gran Salto de Eutobarima [as "Eutonarima"], orillas, 720 m, 8 Oct. 1946, *Cardona 1765* (US, VEN not seen); base central del Guaiquinima-tepui, 85 km S of La Paragua, 500 m, 11 May 1987, *Aymard 5821* (MO, PORT not seen); Cerro Guaiquinima, Río Paragua, Camp 3, 1,200 m, 19 Dec. 1951, *Maguire et al. 32745* (K, NY); Guaiquinima, cumbre, Río Szczerbauari (Carapo), 1–2 km from falls, 750 m, 20 Jan. 1977, *Steyermark et al. 113241* (NY, US, VEN not seen); Guaiquinima, cumbre, Río Szczerbanari (Carapo),

1–2 km from falls, 750 m, 22 Jan. 1977, *Steyermark et al. 113476* (NY, VEN not seen); Sierra Ichún, N de Salto María Espuma (Salto Ichún), 625–725 m, 27 Dec. 1961, *Steyermark 90225* (NY, US, VEN not seen). **Amazonas:** Flanco N del Duida, bosque del Río Negro, afluente del Cunucunuma, 210 m, 3°43′N, 65°35′W, Apr. 1990, *A. Fernández 7613* (MO, PORT not seen); flanco N del Duida, 2 km al S de la población Culebra, 700 m, Apr. 1990, *A. Fernández 7773* (MO, PORT not seen); slope of Cerro Huachamacari, 850 m, 6 Mar. 1985, *Liesner 18339* (MO, NY); vic. y al norte del Cerro Vinilla, ca. 30 km SSW de Ocamo, 440–600 m, 1 Mar. 1984, *Steyermark et al. 130362* (MO, VEN not seen); [Neblina massif], 15 km NNE of Pico Phelps, Camp IV [in Cañon Grande], 780 m, 15–18 Mar. 1984, *Liesner 16708* (MO). For convenience, the following Brazilian record is also included: BRAZIL. **Amazonas:** Rio Maturacá, between Missão [de Maturacá] and Serra Pirapucú [SW of Serra da Neblina], 400–800 m, 13 Jan. 1966, *Silva & Brazão 60814* (K, NY).

The considerable contrast in the leaflet surfaces of *S. japurensis* is further enhanced by retention of the sericeous indumentum on the undersurface; this is reflected in descriptions of it as "rusty" by more than one collector.

Schefflera jauaensis (Maguire, Steyermark & Frodin) Frodin, comb. et stat. nov. Basionym: *Schefflera reticulata* subsp. *jauaensis* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 59. 1984. TYPE: Venezuela. Bolívar: Cerro Jaua, cumbre de la porción central-occidental, 1,922–2,100 m, 22–27 Mar. 1967, *Steyermark 98078* (holotype, NY; isotypes, K (imperfect), VEN not seen).

An amended description is presented because of the exclusion of the original paratype of this taxon as well as the change of rank.

Tree 3 m tall. Leaves 5-foliolate; petiole 40 cm long, 6 mm diam. near base, the base extending into a glabrous stipular ligule 2.4 cm long, its apex acute and body only gradually broadening below the middle; petiolules 2–7.5 cm long, relatively stout in the manner of the petioles. Blades oblong, coriaceous, glabrous, 16.5–20.5 cm long, 8–9 cm wide, showing some evidence of conduplicate folding when fresh, the undersurface reported as silvery green; apex broadly rounded with a short, incongruously small acumen to 0.7 cm long, base shallowly cordate, margin wavy, tucked in at endings of primary veins; midrib fairly prominent; lateral veins about 16 on each side, conspicuous above and below, spreading, not strongly raised when dry but on both surfaces distinct, oriented straight toward margin and ending only at the marginal vein; secondary venation hardly developed and finer reticulation obscure. Inflorescence presumably twice compound, paniculate, slightly whitish appressed-hairy all over, the length of the main axis and number of primary branches not known; primary branches about 60–61 cm long, subtended by a basal bract to 2.5 cm long and bearing numerous capitula; peduncles spreading, 2.2–2.9 cm long with persistent subtending bracts 4–8 mm long; capitula 1.1–1.4 cm diam., about 20-flowered. Ovary 2-locular; stylar column thickened, less than 1 mm long. Maturing fruit about 4 mm long, entirely inferior, distinctly fleshy, somewhat compressed.

Schefflera jauaensis most nearly resembles *S. sessiliflora*, but differs from that species in having longer peduncles and more congested heads with more flowers; the stylar column is also shorter. From *S. contracta* and its relatives it differs in larger leaflets, inflorescences, and heads, although the morphology of the leaflets is most like *S. contracta*.

As originally described, *S. jauaensis* encompassed its type collection and *Steyermark et al. 124075* from Cerro Marutani close to the Brazilian border. The latter, however, is *S. sessiliflora*, a species not reported from the Meseta de Jaua.

Schefflera jauaensis is known only from the type collection and is described as inhabiting dense dwarf recumbent plateau forest bordering streams, of mixed woody growth with *Bonnetia* and *Clusia*. No habitat or association data are available for *S. contracta*, but the related *S. meiurophylla* does occur in comparable situations on Serranía Uasadi.

Schefflera longistyla Frodin, sp. nov. TYPE: Venezuela. Amazonas: Sierra de Maigualida, sector NW, cabeceras del Río Iguana, afluente del Río Asita, 1,720 m, 25 Mar. 1988, *Huber 12692* (holotype, K; isotype, MYF not seen). Figure 15.

Arbor parva *Schefflerae ulocephalae* cognata, sed haec species nova foliis quinquefoliolatis, foliolis latitudine 6 cm non excedentibus etiam inflorescentiis radiorum secundariorum verticillos subsidarios carentibus notata. Ovaria brevissime stipitata atque columna stylaris 3 mm longa.

Tree 4–5 m, with broad, dense crown; twigs pithy, 1 cm across, the surfaces, including the leaf bases, pale brown pubescent. Leaves usually 5-foliolate (3-foliolate in young plants); petiole 10–15.5 cm long, the base broad, sheathing; petiolules 1–2.9 cm long. Blades narrowly elliptic to oblong-elliptic, green and

Figures 15–18. —15 (Top left). *Schefflera longistyla* Frodin. *Huber 12692* (holotype, K). —16 (Top right). *Schefflera meiurophylla* Frodin. *Huber 12875* (holotype, K). —17 (Bottom left). *Schefflera suaveolens* Frodin. *Huber 12837* (paratype, K). —18 (Bottom right). *Schefflera umbraculifera* Frodin. *Huber 12682* (holotype, K).

glabrous above, maroon to grayish maroon and ferrugineous-tomentulose beneath, 6.6–14.6 cm long, 3.2–5.7 cm wide, coriaceous; apex rounded, tip absent or slightly retuse, base broadly acute to obtuse, margins entire, distinctly incurved; upper surface glossy, rugose, the venation and reticulum recessed; undersurface somewhat strongly veined, the midrib prominent, decreasing distally; primary lateral veins 12–15, somewhat spreading-ascending, curving slightly upward before passing into a consolidated marginal vein formed from the anastomoses; secondary veins extending to or nearly to

the margin; cross-veins not regularly developed. Inflorescences initially terminal, later pseudolateral, umbellate, three times compound, at least the secondary bracts persistent; main axis not developed; primary rays ca. 32 cm long, 5 mm diam. in lower part, decreasing to 4.5 mm, initially (along with all other reproductive parts) pale pubescent, later glabrescent, drying dark, their number unknown; secondary rays about 15, 3.2–4 cm long, pale-tomentulose, radiating mostly hemispherically at ends of primary rays (with an occasional ray further down), subtended by bracts 4–5 mm long; ultimate coflorescences tertiary, with an almost headlike cluster of central bisexual, fertile flowers on pedicels 1.5 mm long at ends of secondary rays and about 3 lateral, tertiary, ca. 5- or 6-flowered headlike umbellules arising immediately below, the peduncles and pedicels of the latter respectively 10–13 mm and 1 mm long, pale-tomentulose, the pedicels each subtended by a minute bracteole; calyx rim 1 mm wide, 5-toothed; corolla green; stamens whitish. Immature fruit 4–5 mm long, bright green, 4 mm across, compressed or 3-angled when dry, hardly heterochronous; stylar column 3 mm long, barely bifid or trifid at the apex.

Distinguishing features of *Schefflera longistyla* among related species are the narrowly elliptic to oblong-elliptic, somewhat rugose leaflets, the location of the secondary inflorescence rays usually all at or near the ends of the primary rays, the barely pedicellate flowers (and fruits), reiteration of inflorescences to no more than three times, and, in the fruits, the almost entirely united stylar column. The presence of pedicels separates it from *S. baculosa*, *S. brachypoda*, and *S. ulocephala;* the more evidently united styles, absence of a distinct subsidiary whorl of secondary rays and narrower leaflets separates it from *S. huberi;* and differently colored indumentum and lesser inflorescence reiteration (as well as the lack of a subsidiary verticil of secondary rays) distinguishes it from *S. pallens* (with which the type collection was originally identified).

Schefflera longistyla is one of a partly geographically concentrated series of species, apparently the result of localized diversification on Sierra de Maigualida and Serranía Uasadi. Elsewhere, members include *S. ulocephala* (Cerro Duida, Cerro da la Neblina) and *S. pallens* (Cerro de la Neblina).

Paratypes. VENEZUELA. **Amazonas:** Sierra de Maigualida, sector nor-occidental [locality as for *12692*], 1,720 m, 25 Mar. 1988, *Huber 12696* (K, MYF not seen); Sierra Maigualida, NW sector, small valley along upper tributary of Caño Iguana, 2,000 m, 5°30′N, 65°15′W, 28 Feb.–3 Mar. 1991, *Berry et al. 4834* (MO).

Schefflera maguireorum Frodin, nom. et stat. nov. Replaced name: *Schefflera reticulata* subsp. *yutajensis* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 59. 1984, not Steyermark & B. Holst, 1988. TYPE: Venezuela. Amazonas: Cerro Yutajé, summit, NW Ridge, Río Manapiare, 1,400 m, 11 Feb. 1953, *Maguire & Maguire 35154* (holotype, NY; isotype, K).

An amended description is presented because of the transfer in this paper of one of the two original paratypes of this taxon to *S. asymmetrica* and the change of rank.

Tree 4 m tall; twigs initially 12–13 mm diam., increasing to 15 mm. Leaves 7- or 8-foliolate, the leaflets in a single plane; petioles 30–33 cm long, remaining sparsely gray-woolly through anthesis, later glabrescent, the axis emerging about halfway up the base, the free portion of the stipular ligule about 1.2 cm long; petiolules 2–4 cm long, initially thinly pubescent. Blades elliptic to narrowly elliptic, coriaceous, tending to be conduplicately folded, 12.5–15 cm long, 4.8–5.9 cm wide, glabrous with some scattered hairs near midrib on undersurface; apex obtuse, the tip shortly acuminate (not caudate), base ± smoothly rounded, margin slightly wavy; upper surface ± glossy; undersurface dull, slightly paler than the upper; midrib fairly prominent beneath; primary lateral veins 9–12 on each side, only slightly raised below, spreading and curving upward slightly, extending to and uniting with the marginal vein; secondary lateral veins scarcely developed, with reticulation usually including 2 or 3 irregular cross-veins on each side toward the margins. Inflorescences terminal, twice compound, paniculate, with (6)7 or 8 radiating primary branches; main axis short; branches 25–33 cm long, finely but ± densely buff-pubescent at anthesis, subtended by basal bracts 2 cm long; headlike flower clusters numerous, crowded along most of the length of the branches, irregularly spaced, with some naked secondary bracts below them; peduncles 1–2.5 cm long, buff-pubescent, their subtending bracts 5–7 mm long. Flowers yellowish; pedicels about 0.75 mm long, densely buff-pubescent as the ovaries, each subtended by one bracteole; calyx rim very narrow, with 5 minute teeth; petals 5, coherent in a calyptra, the calyptra opening basally as the stamens expand with the segments separating upward; stamens ca. 3 mm long; anthers reddish; ovary about 1.25 mm long, the disk flat, the stylar column 2 mm long, its lower ⅓ pale and upper ⅔ dark when dry. Fruit as yet unknown.

Schefflera maguireorum was originally described as a subspecies of *S. reticulata* (Gleason) Maguire, Steyermark & Frodin, but here the flowers are less clearly in heads; rather they are in congested clusters. The species thus links capituliferous (such as *S. jauaensis* and *S. sessiliflora*) and umbelluliferous (such as *S. concolor* and *S. paruana*) members of what appears otherwise to be a rather natural alliance—the "Cheilodromi"—all but confined to Guayana, characterized most notably by marginally veined leaflets, paniculate inflorescences with elongate primary branches, and 2(3)-pyrened, wholly inferior fruits. The weakness as a character of the distinction between heads and umbellules has been discussed elsewhere (Frodin, 1975).

Floral distinctions aside, the leaflets in *S. maguireorum* and *S. paruana* are superficially similar. However, those in the latter are somewhat larger and more thinly coriaceous, and the subsidiary lateral veins are somewhat more consistently developed, with no evident cross-veins; in the former there are usually two or three such veins, any subsidiary venation usually being undeveloped or with occasional elongate secondary veins. In addition, in *S. paruana* the basal veins are more discrete, the undersurface somewhat glossier, and the midrib there less prominent.

From *Schefflera asymmetrica*, the first collection of which was originally included here, *S. maguireorum* can be distinguished by its smaller, more oblong leaflets with lesser development of secondary lateral venation, and flowers in almost headlike clusters with very short pedicels. Similarly, *S. concolor* has larger leaflets and flowers in distinct umbellules.

Schefflera maguireorum is known only from the type collection and has been described as occurring in scrub on ridge summits. Its reported altitude is below that of the summit area and falls within the known local range of *S. suaveolens* (1,375–1,760 m) as well as the ranges, on other mountains, of more closely related species such as *S. nigrescens*, *S. paruana*, and *S. pedicelligera*.

Schefflera marahuacensis (Maguire, Steyermark & Frodin) Frodin, comb. et stat. nov. Basionym: *Schefflera tremuloidea* var. *marahuacensis* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 63. 1984. TYPE: Venezuela. Amazonas: Cerro Marahuaca, cumbre, sección NW, 2,500 m, 16 Feb. 1981, *Steyermark, Brewer-Carías & Liesner 124406* (holotype, NY; isotypes, MO, US, VEN not seen).

Trees 3–4 m tall; twigs pithy, 11–14 mm diam. Leaves 6-foliolate, tightly clustered toward twig ends; petioles glabrous, 16.5–19 cm long, emerging halfway up their associated stipular ligules; ligules 2–2.5 cm long, 2 cm broad at base, with pale, scarious margins 1 mm wide; petiolules 4–6 cm long. Blades glabrous, ovate-elliptic, 5.8–11.2 cm long, 3.4–7.8 cm wide, coriaceous; apex acute, passing into an acumen 8–10 mm long (on new shoots the acumen to 25 mm), base obtuse to rounded, margin entire; both surfaces ± glossy, the upper more strongly shining; midrib on undersurface prominent, raised; primary vasculature comprising a pair of prominent, spreading basal veins and 9 or 10 additional veins on each side, the latter somewhat irregularly spaced, spreading-ascending, extending to margin, somewhat prominent on undersurface but hardly raised; secondary veins partly developed; reticulation coarse. Inflorescence terminal, twice compound, paniculate; main axis absent; primary branches few, 25–46.5 cm long, drying dark purple or blackish, subtended at base by bracts 2 cm long; flowers in numerous racemosely arranged, fairly congested umbellules arising along upper ⅔ of primary branches, their peduncles 10–21 mm long and subtended by persistent secondary bracts ca. 2 mm long; pedicels 1.5(–2) mm long, each subtended by 1 minute bracteole; calyx rim scarious, with 5 small teeth; ovary obconic, about 1 mm long.

The large stipular ligules ("auricles" in the protologue), broader leaf bases, and larger leaflets were the character states originally used to distinguish these plants at varietal rank. Reexamination of the type, along with a subsequent collection, suggests that the twigs are also larger and thicker than in any of the material of *S. tremuloidea* Maguire, Steyermark & Frodin var. *tremuloidea*, the leaflets are thicker and more oblong, the umbellules are more uniformly and extensively distributed along the inflorescence branches, and the peduncles are shorter. Indeed, these plants are perhaps less closely allied to variety *tremuloidea* than that taxon is to *S. pedicelligera*, originally ranked as a species. Variety *marahuacensis* seems, therefore, worthy of specific rank.

I am not able at present to postulate any close allies for *S. marahuacensis*. Apart from *S. tremuloidea*, it is altitudinally the highest known member of its series. All collections to date come from Cerro Marahuaca, where it occurs in forests along creeks on the tepui summit at 2,500–2,600 m elevation.

Additional specimen examined. VENEZUELA. **Amazonas:** Cerro Marahuaca, cumbre, parte central de la meseta sud-oriental, Quebrada Yekuana, 2,560 m, 10–12 Oct. 1983, *Steyermark 129431* (MO, NY, VEN not seen).

Schefflera meiurophylla Frodin, sp. nov. TYPE: Venezuela. Amazonas: Serranía Uasadi, sector NW, cumbres montañosas ubicadas en las cabeceras orientales del Río Asita, afluente derecho del Río Ventuari, ± 1,850 m, 22 Nov. 1988, *Huber 12875* (holotype, K; isotype, MYF not seen). Figure 16.

Arbor *Schefflerae contractae* valde affinis, sed ab ea foliis fere truncato-obovatis nec conduplicatis paginis superna infernaque minus discrepantibus recedit; vere inter duas omnino in effectu exiguior.

Tree 4–6 m tall, sparsely foliaged and somewhat flat-topped, with a slight smell when cut. Leaves gathered toward twig ends, 5- or 6-foliolate; petiole glabrous, somewhat darkened when dry, 6.5–14 cm long, less than 3 mm thick, the base extending into a stipular ligule > 3 mm long, acute; petiolules 1–4.1 cm long, ca. 1.5 mm thick. Blades almost truncate-obovate, widest well above the middle, stiff when dry, green above, pale green below, 5.7–11.8 × 3–6.7 cm, not conduplicately folded; apex rounded-truncate, occasionally slightly emarginte, the tip cuspidate-acuminate, 5–6 mm long, base broadly cuneate, and margins somewhat incurved; upper surface when dry ± shining, not much darker than lower surface, the veins conspicuous; lower surface with midrib only somewhat prominent, the veins ± distinct from the mesophyll; primary lateral veins closely spaced, 12 or 13 on a side, ascending, extending straight to margin and little forking; secondary veins fairly well developed, breaking into irregular fine reticulation but without evident cross-veins. Inflorescences terminal, semi-erect, twice compound, paniculate, the axes rather dark maroon; length of main axis or number of branches not known; primary branches (from different inflorescences) 14.5–39.5 cm long, 2–4 mm diam., patchily or thinly pale hairy; bearing racemosely arranged capitula in the upper ¾ and subtended by a basal bract to 2 cm long; peduncles pale hairy, 6–12 mm long, ca. 1 mm diam., subtended by persistent bracts 2–3 mm long; capitula ca. 5 mm across after anthesis, later up to 10 mm, ca. 15-flowered; calyx rim narrow, 5-toothed; ovary 2-locular, the disk flat or slightly sloping, small, passing into a short but distinct stylar column 0.5 mm long with free parts to another 0.25 mm long. Fruit obovoid-ellipsoid, to 5 mm long and 4 mm across, wholly inferior, initially green, later red; stylar column persistent.

Schefflera meiurophylla is most closely related to *S. contracta* and also shows affinities with *S. argophylla*. It differs from *S. contracta* in the petioles longer in relation to the blade length and thus less congested; the petiolules as well as the petioles less stout and not obviously purplish; the blades not conduplicate and distinctly obovate with the widest point well above the middle; the surfaces of the blades with less contrast; and the midrib on the undersurface less prominent.

Schefflera meiurophylla is known only from the type collection and occurs in low, mixed montane forests, at least sometimes along creeks. On the Sierra de Maigualida it seems to occur in moister habitats than *S. argophylla*.

Schefflera monosperma Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 51. 1984. Replaced name: *Crepinella gracilis* E. Marchal ex Im Thurn, Timehri 5: 195. 1886; Trans. Linn. Soc. ser. 2, Bot. 2: 275. 1887, not *Schefflera gracilis* (Miquel) Viguier 1909. TYPE: Venezuela [as "Guyana"]. Mt. Roraima, upper slope, above 5,000 ft., 10 Dec. 1884, *Im Thurn 162* (lectotype, K; isotype, BM).

When Maguire et al. (1984) proposed the new name *Schefflera monosperma* for this species, the reference for the replaced name was incomplete and is given in full here. With the segregation of *Schefflera cracens*, discussed more fully under that species, *S. monosperma* becomes limited to the Roraima-tepui and its outliers. Further collections have become available or have been rediscovered in the last decade and are cited below. *Maguire & Maguire 40837*, doubtfully identified in Maguire et al. (1984), is confirmed as *S. monosperma*. Observation of fruiting material supports the contention of Baumann-Bodenheim (1955) that the ovary is pseudomonomerous.

Additional specimens examined. GUYANA. Mt. Roraima, 6,900 ft., 26 Mar. 1978, *A. Hedley & P. J. Edwards KER.081* (K); Mt. Roraima, escarpment, 7,600 ft., 1 Nov. 1973, *Persaud 144* (BRG not seen, K). VENEZUELA. **Bolivar:** Uei-tepui (Serra do Sol), on Brazil/Venezuela frontier, 6,500 ft., 28 Dec. 1954, *Maguire & Maguire 40837* (K, MG not seen, NY, VEN not seen). BRAZIL. Mt. Roraima, Abhang, 2,200 m, Jan. 1910, *Ule 8706* (K, L).

Schefflera morototoni (Aublet) Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 51. 1984. TYPE: illustration of *Panax undulata* [sic] Aublet, Hist. Pl. Guian. 2: pl. 360. 1775; supporting herbarium collection yet to be selected, but at BM there is an Aublet specimen seen by both Seemann (1868) and the author.

Panax splendens Kunth in HBK, Nov. Gen. Sp. 5: 11 (ed. fol. 9). 1821. *Schefflera splendens* (Kunth)

Frodin ex Lindeman in A. Pulle et al., Fl. of Suriname 3(2): 352. 1986. *Didymopanax splendens* (Kunth) J. Decaisne & Planchon ex Seemann, J. Bot. 6: 132. 1868. TYPE: Colombia. Cauca: Popayán, *Humboldt & Bonpland s.n.* (lectotype, selected by Seemann, 1868, P not seen).

Panax splendens Kunth was first reduced to the slightly earlier name *Aralia micans* Humboldt & Bonpland ex Schultes by Krug & Urban (1899). They retained that taxon, however, as a distinct species under the name *Didymopanax micans* (Humboldt & Bonpland) Krug & Urban. It is perhaps not yet fully recognized that both of these names, which may be homotypic (Jan Lindeman, pers. comm.), represent the juvenile form of *S. morototoni.* The capitula included with the type of *Aralia micans* (B-WILLD) are extraneous.

Prance et al. 4700 should be omitted from the list of exsiccatae given under this species in Maguire et al. (1984: 51–52); it is a distinct species, which will be described elsewhere.

The following records from the Venezuelan Guayana are assigned here to *Schefflera morototoni:* **Amazonas:** Alto Orinoco, Isla del Esfuerzo, ca. 200 m, 5 Sep. 1951, *Croizat 562* (F); bosque ribereño del Río Asisa, 100 m, 4°30′N, 65°48′W, Oct. 1989, *L. Delgado 887;* Río Puruname, 40 km above mouth, ca. 100 m, 29 May–5 June 1982, *Huber & Tillett 06390* (K, MYF not seen); Río Orinoco, Caño Tama-Tama, 150 m, 12 Sep. 1954, *J. S. Level 142* (MO, NY); Cerro Sipapo, Caño Grande, slopes above lower escarpment, 4,500 ft., 21 Jan. 1949, *Maguire & Politi 28528* (MO, NY, VEN not seen); Sierra Parima, near Simarawochi, 795–830 m, 18 Apr.–25 May 1973, *Steyermark 107383* (NY, VEN not seen); Frente No. 1, Piedra Sapo, Río Atacavi, 140 m, Nov. 1989, *J. Velazco 0997* (MO, PORT not seen). **Bolívar:** Campamento "El Paraíso," 48 km NE del caserío Los Rosos, 17 km de Upata, altitude not given, Apr.–June 1965, *Blanco 039* (US, VEN not seen); Cerro Curichapo, 25 km al NE de la Paragua, 450 m, Mar. 1987, *Fernández 4083* (MO, PORT not seen); bosque en lomerío 4–5 km al N del Cerro Camarón, Macizo Guaiquinima, 240 m, Oct. 1988, *Fernández & Aymard 4813* (MO, PORT not seen); alrededores de San Ignacio, 240 m, 27 Apr. 1987, *L. Hernández 486* (MO); SW slope of Amuray-tepui, E of Auyán-tepui, W of Aparamán-tepui, 600–700 m, 28 Apr. 1986, *Holst & Liesner 2742* (MO); 20–35 km SW of Manteco, road to San Pedro de las Dos Bocas, ± 200 m, 1–3 Aug. 1978, *Liesner & González 5862* (MO, VEN not seen); Chinese Slide, Cerro Bolívar, 300–400 m, 24 Oct. 1953, *Maguire et al. 35966* (NY, VEN not seen); Mina "Los Pijiguaos," Bajo Río Suapure, altiplanicie de la Mina, ± 600 m, Apr.–May 1987, *Ramírez & Paredes 77* (MO, MYF & TFAV not seen); Imataca, altitude not given, July 1983, *Stergios et al. 6032* (MO, PORT & UEC not seen); Gran Sabana, between Kun and Uaduara-parú [S of Mt. Roraima], 1,065–1,220 m, 1 Oct. 1944, *Steyermark 59085* (F); between Santa Teresita de Kavanayén and Río Pacairao (tributary of Río Mouak), 1,065–1,220 m, 20 Nov. 1944, *Steyermark 60436* (F, NY); Cerro La Reforma, above junction of Río Reforma with Río Toro, 200–250 m, 15 Dec. 1960, *Steyermark 88099* (F, GH, NY, US); Río Paramichi entre la boca del Río Paramichi y el Salto de Chalimano, 525–625 m, 8 Jan. 1962, *Steyermark 90762* (NY, US, VEN not seen); bosque a 2 km al NE de Santa María de Erebato, 370 m, Feb. 1989, *M. Sucre 2562* (MO, PORT not seen); Medio Caura, Salto de Pará, 280 m, 9 Mar. 1939, *Ll. Williams 11455* (F, US, VEN not seen); at E base of Cerro Coroba, Hato la Vergareña, 400 m, 19 Oct. 1954, *Wurdack & Guppy 124* (F, NY, US); Cerro Marimarota, 100–250 ft., 26 Jan. 1956, *Wurdack & Monachino 41384* (MO, NY, VEN not seen). **Delta Amacuro:** 5–14 km ESE of Los Castillos de Guayana, 50–200 m, 28 Mar.–2 Apr. 1979, *Davidse & González 16279* (MO, VEN not seen); mountain area ca. 13 km by road ESE of town of Sierra Imataca, 400 m, 4–6 Apr. 1979, *Davidse & González 16582* (MO, VEN not seen); vicinity of Caño Jotajana, tributary of Caño Guiniquina, NW of Epaña, 50 m, 20 Oct. 1977, *Steyermark et al. 115094* (MO, VEN not seen).

Schefflera morototoni var. **angustipetala** (E. Marchal) Frodin, comb. nov. Basionym: *Didymopanax morototoni β angustipetalum* [sic] E. Marchal in Martius, Fl. Bras. 11(1): 241. 1878. TYPE: Venezuela. Amazonas: Pacimoni River, banks, low altitude, [11–12] Feb. 1854, *Spruce 3456* (K, NY; lectotype not selected at this time).

This taxon has evidently not been recorded before for Venezuela. Marchal, in his protologue, mistakenly attributed the type locality to Brazil; but the Río Pacimoni, a tributary of Brazo Casiquiare, lies wholly within Venezuela (Huber & Wurdack, 1984).

Marchal distingushed this variety by its petals being three times as long as broad and by the peduncles of the umbellules being reflexed. To this may be added that the leaves are only 5-foliolate, the primary veins of the leaflets curve continuously, the inflorescence appears only to be twice compound, with primary branches to 38 cm long, and

the peduncles are 3–4 cm long, with the longer ones toward the ends of the branches. However, with the imperfect collections available (neither of them fruiting) I hesitate to recognize it at any higher rank.

The reflexed peduncles resemble another species, as yet undescribed, which occurs outside the Venezuelan Guayana in a broken arc from eastern Colombia to northeastern Peru. Representative collections include *Schultes & Cabrera 16010* (GH, US) and *Croat 18642* (MO, NA). The foliage may be compared with *S. tamatamaensis* Maguire, Steyermark & Frodin, but without knowledge of the fruits in the present taxon no further comparisons are attempted.

Additional specimen examined. Venezuela. **Amazonas:** Caño Tama-Tama, 2 km al E de Tama-Tama, 140 m, 3°07′N, 65°50′W, 3 Mar. 1990, *Aymard & Delgado 8430* (MO, PORT not seen).

Schefflera myrioneura Frodin, sp. nov. TYPE: Venezuela. Amazonas: Cerro Sipapo, Phelps Camp to North Savanna, 1,400 m, 17 Dec. 1948, *Maguire & Politi 27738* (holotype, K; isotypes, MO, NY, US).

Arbor mediocris ad 15 m alta, *Schefflerae psilophyllae* ut videtur affinis sed ab ea foliolorum venis numerosissimis (primariis cum secundariis 35–60) atque arte patentibus et fructu in statu sicco non sulcato differt. Bene notabilis.

Tree 12–15 m tall, the trunk 12–15 cm diam. Leaves (4–)6–8-foliolate; petiole ca. 24 cm long, 4 mm diam.; petiolules 2.4–7 cm. Blades usually oblong-obovate but sometimes obovate, glabrous, 9.5–25.5 cm long, 6.7–8.6 cm wide, chartaceous when dry; apex broadly rotund or truncate, ± distinctly emarginate, base acute to more usually broadly obtuse, the edges sometimes recurving into the petiolule, margins entire, in the dry state slightly incurved; surfaces when dry about the same color or the upper slightly lighter; midrib moderately prominent beneath, longitudinally collapsing on drying; lateral venation very fine, the primary and secondary veins together 35–60 on each side, spreading, extending to a continuous marginal vein, the veins sometimes narrowly once divaricating toward the margin; tertiary lateral venation ± elongate, emerging from the midrib or primary or secondary lateral veins. Inflorescence initially terminal but later pseudolateral, umbellate, compound, the primary and secondary branches stiff, straight, and stout; main axis hardly developed; primary rays 3 or 4, glabrous, 11.5–27 cm long, 4–5 mm diam., with or without a subsidiary whorl of secondary rays (when present, the upper internode > 4.5–6 cm long); secondary rays flattened, 2.5–6.5 cm long, up to 10 at ends of primary branches and 2–4 in subsidiary whorls, those at the ends oriented in all directions; ultimate coflorescences umbellate, with 3–5 central, bisexual flowers on pedicels 5–7 mm long and lateral tertiary reiterations with flattened peduncles (tertiary rays) 1–2.7 cm long and congested clusters of flowers on pedicels 2–3 mm long; flowers small, 4 × 2 mm in bud, the calyx rim poorly developed with minute teeth, the corolla calyptrate, pale when dry; ovary drying dark, 3- or 4-locular, the stylar column ca. 1 mm long. Fruit 9–10 mm long, 7–8 mm across, the widest point above the middle during maturation, remaining inferior, the disk depressed, ca. 2 mm across, the stylar column 1.5 mm long without free portions.

Schefflera myrioneura differs from *S. psilophylla*, where it was previously included by Maguire et al. (1984), in having fewer primary rays in the inflorescence as well as emarginate leaf apices. It also differs from *S. suaveolens* in the presence of fewer terminal secondary rays, larger fruits, and united styles. From both these species it differs in its very fine lateral venation, although in this respect it is closer to *S. suaveolens*. The inflorescence has an angular appearance, which among presumably related species in the Guayana can best be compared with *S. pallens* rather than either *S. psilophylla* or *S. suaveolens*.

This new species is an occasional to frequent tree of wet mixed montane forests, some at least of a mossy aspect. Like many other araliads in forest zones, it may be an opportunist, taking advantage of gaps created by rockfalls, windthrows, or fires, or dwelling on forest or scrub edges. The structure of the vegetative parts suggests that a considerable amount of water may be lost upon drying. By contrast, the fruits when dry do not shrink around the pyrenes as is common in most species of *Schefflera;* in this they may be compared with *S. gabriellae* Baillon of New Caledonia.

Schefflera myrioneura is one of the distinctive endemics of Cerro Sipapo, along with *S. crassilimba*, *S. pauciradiata* Maguire, Steyermark & Frodin, and *S. sipapoensis* Maguire, Steyermark & Frodin. This westernmost of the Venezuelan Guayana tepuis, however, is "merely the highest point in a vast area of gently rising contour" (Paynter, 1982: 189). Shortly to the east are two patches depicted on the vegetation map of Huber & Alarcón (1988) as having "vegetación tepuyana"; these areas are apparently unexplored botanically. This suggests a possible larger "support area" for four such distinctive endemics—two of them initially described in 1984—rather than merely the 55 km² summit area (95

km² if the talus slopes are included) of Cerro Sipapo alone.

Paratypes. VENEZUELA. **Amazonas:** Cerro Sipapo, Savanna Camp to North Escarpment, 1,400 m, 23 Dec. 1948, *Maguire & Politi 27880* (K, NY); Cerro Sipapo, above Caño Grande, 1 km NW of Savanna Camp, 1,500 m, 28 Dec. 1948, *Maguire & Politi 28015* (K, NY); Cerro Sipapo, above lower escarpment, above Caño Grande, 4,500 ft., 21 Jan. 1949, *Maguire & Politi 28539* (K, NY).

Schefflera neblinae (Maguire, Steyermark & Frodin) Frodin, comb. et stat. nov. Basionym: *Schefflera coriacea* subsp. *neblinae* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 79. 1984. TYPE: Brazil. Amazonas: slope of Serra Pirapucú [NE of] Rio Maturacá, [SW of] Serra da Neblina, 1,300 m, 26 Jan. 1966, *Silva & Brazão 60903* (holotype, NY; isotype, K).

Tree 3 m high, 10 cm diam. Leaves 5- or 6-foliolate; petioles 10–13.5 cm long, the sheathing base small; petiolules 1.3–2.1 cm. Blades oblong-elliptic to oblong-obovate, usually broadest above middle, the surfaces contrasting, 9–13.1 cm long, 4–5 cm wide, coriaceous; apex broadly obtuse, usually ending in a broad point, base obtuse, rounded at insertion and not decurrent, margin only narrowing about ½–⅔-way down from apex, incurved but not noticeably inrolled; upper surface glabrous, the venation hardly impressed, undersurface grayish hairy, the indumentum tightly appressed; midrib prominent below; primary lateral veins about 12–14 on a side, ± closely parallel, just showing as thin lines on undersurface, near margin suddenly anastomosing and each joining with the primary vein below; secondary venation not well developed, usually breaking and toward margin joining with primary vein below. Inflorescence terminal, compound-umbellate; primary rays ca. 3–5, 28–30 cm long, drying very dark; secondary rays both at apex and in a single subsidiary whorl, some 20–23 at the former, far fewer at the latter; all axes dark sericeous-pubescent, the hairs much appressed, but later glabrescent; umbellules 13–15-flowered, the pedicels fairly slender, 7–9 mm long, sericeous-hairy; buds 3 mm long; petals 5, in bud sericeous without, at anthesis spreading outwards before falling; ovary 3-locular, the stylar column united, 0.5 mm long.

This species is known only from the type collection. For *Prance, Steward, Ramos & Farias 9796* from the Serra Parima, formerly included with the subspecies (Maguire et al., 1984: 79), see *Schefflera varisiana;* the remaining records included by Maguire et al. (1984: 79–80) are *S. acaropunctata.*

The generally smaller foliage and inflorescences, the absence of a distinctively reddish indumentum, and a shorter stylar column along with the trilocular ovary all indicate that specific rank is merited for this taxon. The only known locality of *S. neblinae* is relatively remote from the reported range of *S. coriacea*, although *S. varisiana*, clearly a sister species of *S. neblinae*, occurs closer. *Schefflera neblinae* is also allied to *S. pauciradiata* Maguire, Steyermark & Frodin.

Schefflera nigrescens Frodin, sp. nov. TYPE: Venezuela. Amazonas: 1 km N of Camp XI, 6.5 mi. NNE of Pico Phelps [Cerro Neblina], 1,300 m, 28 Feb. 1985, *Nee 31186* (holotype, NY; isotypes, MO, US).

Species habitu formaque *Scheffleras varisianam* et *neblinam* in memoriam redigit, sed haec species nova foliolis anguste obovatis, ad basin cuneatis vel attenuatis, in pagina super minus rugulosis, ad apicem late obtusatis vel rotundatis notata. Foliola valde in colore discrepantes, inter paginas supernam infernamque.

Tree 8 m tall, trunk to 20 cm diam. Twigs fairly slender, 6 mm across in upper portion when dry. Leaves 5- or 6-foliolate; petioles 15–16 cm long, 2 mm diam.; basal sheath not extending into a stipular ligule; petiolules 1–2.5 cm long. Blades in a single plane, narrowly obovate, 9.2–13 cm long, 3.3–4.4 cm wide, thinly coriaceous; surfaces contrasting, the upper quite glossy, drying quite dark, glabrous with distinctly sunken primary and secondary lateral veins, the under finely golden tan hairy, with only the midrib prominent; apex rounded or broadly obtuse, passing into a short acumen 2–3 mm long, base cuneate or attenuate, not constricted at insertion with the petiole, margins when dry curving slightly upward; lateral veins many, spreading-ascending, less hairy below and so contrasting with the pubescent mesophyll, visibly camptodromous, arching near but not evidently reaching the margin, the intramarginal loops obscure. Inflorescence compound-umbellate, probably terminal and without a main axis; primary rays 2(3?), about 25 cm long, bearing at some 8–10 cm below the end a subsidiary whorl of 2–5 secondary rays 2.6–4 cm long, the remaining secondary rays all at the end; terminal sprays comprising 19–21 secondary rays (or peduncles) 2.3–3.4 cm long, these somewhat golden sericeous at anthesis and ending in 10–15-flowered umbellules; pedicels 7–9 mm long. Flowers small; buds 3.5 mm long, petals 5, ca. 1 mm or so long, ± sericeous outside, their base hidden by the calyx rim, opening

from the top and spreading before falling; disk slightly sloping from a sunken base, to 2 mm across; free portion of calyx rim obscure; ovary usually 3-locular, ± straight, 1–1.5 mm long, then suddenly widening below calyx rim; stylar column short. Fruit not known.

Related species include *Schefflera varisiana* and *S. neblinae*, both of which have compound-umbellate inflorescences with a single subsidiary whorl of secondary rays and ± sericeous indumentum. *Schefflera nigrescens* differs from these in the more distinctly obovate leaflets, the greater contrast of their surfaces, and finer venation. *Schefflera neblinae* has more oblong-obovate to oblong-elliptic leaflets with bases rounded at the insertion of the petiole; it is presently known only from Serra Pirapucú, an isolated range near the southwestern corner of the Neblina massif but mostly cut off from it by the Rio Ariabá.

Schefflera nigrescens is known only from the type collection and is found in cloud forest on ridges and slopes north of the southern rim of the Neblina massif, falling toward Cañon Grande and the Río Baría. Nearby Camp XI was in the upper reaches of the most northern tributary of the Cañon Menor (maps in Brewer-Carías, 1988: 11, 39).

Schefflera pallens Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 72. 1984. TYPE: Brazil. Amazonas: trail to Pico Phelps, Serra da Neblina, 2,425 m, 3 Dec. 1965, *Maguire et al. 60503* (holotype, NY; isotype, NY).

Nee reported that this tree did not occur much below the site of Camp VII (1,730–1,850 m; Brewer-Carías, 1988: 149). This suggests that it is probably confined to the higher parts of the Neblina massif, perhaps in relatively open places above the main montane forest zone. More collections are needed, however, to ascertain the relative distribution, frequency, and abundance of this and two other species apparently characteristic of the tepui vegetation zone on Neblina, *S. eximia* (described above) and *S. simplex* Steyermark & B. Holst.

Additional specimen examined. VENEZUELA. **Amazonas:** [Cerro de la Neblina] Camp VII, 4 km NE of Pico Phelps, 1,950 m, 4 Feb. 1985, *Nee 30749* (MO, NY, US).

Schefflera paruana Frodin, nom. nov. Basionym: *Schefflera guanayensis* subsp. *paruensis* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 67. 1984. TYPE: Venezuela. Amazonas: Cerro Parú, Río Parú, Caño Asisa, 1,800 m, 12 Feb. 1951, *Cowan & Wurdack 31405* (holotype, NY; isotype, K).

The epithet "*paruensis*" is not taken up here for the species because of the previously existing name *Schefflera paraënsis* Huber, which might cause confusion.

An emended description is furnished below, given the change in status proposed and the exclusion of two of the paratypes (now referred to *S. clausa*) from the account in Maguire et al. (1984).

Slender, probably sparingly branched tree 3–8 m tall; twigs to 1.5 cm diam. Leaves 4–11-foliolate; petioles to 37 cm long and decreasing from 5 to 2.5 mm diam., emerging from the sheathing base at 2 mm above its insertion with the node, the free portion of the base, or ligule, to more than 2.5 cm long; petiolules 3.5–8.5 cm long, fairly slender. Blades oblong-elliptic to oblong-obovate, glabrous, 7–18 cm long, 5.4–7.4 cm wide, thinly coriaceous; apex obtuse, the tip acuminate, to 1 cm long, base rounded, margins flat, vertically a little wavy, slightly tucked in at vein endings and thickened by a marginal vein; upper surface dull, undersurface somewhat glossy; venation of coarse appearance, primary lateral veins 8–10, spreading-ascending, joining with the marginal vein, secondary veins partly developed, organized cross-veins not evident. Inflorescence terminal, paniculate, twice compound; main axis short, thickened; primary branches 20–30, 47–68 cm long, ca. 5 mm diam., thinly grayish hairy; peduncles racemosely arranged, 65–85 in upper ¾ to ⅘ of the branch, 0.4–1.1 cm long, subtended by persistent small puberulent bracts, the umbellules 7–9-flowered; pedicels 1.5–3 mm long; flowers after anthesis 1–1.5 mm long, with flattened disk and stylar column about 1 mm long, the ovary 2-locular.

Schefflera paruana was originally distinguished from *S. guanayensis* at the subspecific level on account of its larger, oblong-elliptic leaflets, and greater number of peduncles on each primary branch. However, when viewed in a wider context and with the use of additional characters, each of the nonnominate subspecies described with *S. guanayensis* merits specific rank.

Schefflera paruana is most closely related to *S. marahuacensis* and *S. pedicelligera* Maguire, Steyermark & Frodin, both endemics of the central-southern tepui region, and *S. crassilimba* and *S. maguireorum* in the northwestern tepui region (Huber, 1988). It differs from *S. pedicelligera* mainly in its more densely crowded and numerous umbel-

lules with shorter peduncles and pedicels, obtuse to rounded leaflet bases, and petiolar insertion; from *S. marahuacensis* it differs by its longer, differently shaped, less strongly veined leaflets. The partial union of petiole and base above the insertion of the latter is a character state shared by this species with *S. marahuacensis*. A longer acumen, along with leaflet size and color (when dry), distinguishes *S. paruana* from *S. crassilimba*. From *S. maguireorum*, with somewhat similar leaflets, it differs in the umbellules not being headlike and with very short pedicels. *Schefflera paruana* is characterized by up to 20–30 primary branches in the inflorescence, a state apparently paralleled by *S. steyermarkii* but more than in the four aforementioned species.

Schefflera paruana is a tree of summit streams and the bases of tepui escarpments; it appears to be part of the tepui vegetation zone and in the upper part of the montane zone (Huber & Alarcón, 1988). Along with *S. asymmetrica* and *S. concolor* in the south and *S. ayangannensis* Maguire, Steyermark & Frodin in Guyana, it appears to be one of the more generalized species in its series.

Additional specimen examined. VENEZUELA. **Amazonas:** Cerro Parú, from camp caño to Point 2 (just N of Point 1), 2,000 m, 31 Jan. 1951, *Cowan & Wurdack 31072* (K, NY).

Schefflera psilophylla (Harms) Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 68. 1984. TYPE: Venezuela. Bolívar: Mt. Roraima, 1,900 m, *Ule 8702* (lectotype, here designated, G; isolectotypes, K, L).

The exclusion of most records included here by Maguire et al. (1984)—either to *S. myrioneura* or *S. suaveolens*—indicates that *S. psilophylla* is limited to mid-elevations on Roraima and Ilú-tepui. Three collections are known: *Ule 8702* (G, K, L); *Maguire et al. 33364* (K, NY), and *33484* (K, NY).

Schefflera quinquecarinata Steyermark, Bol. Soc. Venez. Ci. Nat. 25(106): 44, fig. 2. 1963. TYPE: Venezuela. Bolívar: vicinity of Km 134, bordering headwaters of Río Cuyuní, NE of Luepa, *Steyermark & Nilsson 483* (holotype, VEN).

Tillett et al. 45736 should be excluded from the list of records in Maguire et al. (1984: 5). It is a form of *S. morototoni*, but its status has yet to be resolved. In addition, *Prance et al. 10159* from Serra dos Surucucus in Roraima Territory, Brazil, distributed as this species but not listed in Maguire et al. (1984), appears to be *S. yutajensis* Steyermark & B. Holst, a vicariant species. *Schefflera quinquecarinata* thus remains limited to a relatively small area on the Venezuela–Guyana border.

Schefflera quinquestylorum Steyermark, Bol. Soc. Venez. Ci. Nat. 25: 46. fig. 3. 1963. *Schefflera duidae* subsp. *quinquestylorum* (Steyermark) Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 54. 1984. TYPE: Venezuela. Bolívar: Cerro Venamo, NW slopes, SE of road camp 125, to line of NE-facing sandstone bluffs, 1,100–1,140 m, 21 Apr. 1960, *Steyermark & Nilsson 429* (holotype, VEN not seen; isotypes, K, NY).

This taxon is not simply a vicariant of *S. duidae* but part of a small series of apparently sibling taxa, mainly in eastern Colombia and with links to *S. sprucei* (Seemann) Harms. Moreover, the leaflets are more acute, with a caudate-acuminate tip, and when dry exhibit greater surface contrast; the pubescence on the undersurface of the leaflets, when present, is also differently colored. There is also no evidence, as in *S. duidae*, that this is a facultative liana. I thus propose renewing its recognition as a species.

Geographically, the area of *S. quinquestylorum* is centered on Cerro Venamo and is limited by comparison with *S. duidae*, which is now known to range from Cerro Marutani to the central-southern tepuis (Huber, 1988) and south to Serra Aracá and Serra Pirapucú (the latter near the Neblina massif) in northern Brazil.

Schefflera sessiliflora Splithof-Heerschop ex Frodin, nom. nov. Replaced name: *Schefflera reticulata* (Gleason) Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 57. 1984, not Philipson, 1951. Basionym: *Didymopanax reticulatus* Gleason, Bull. Torrey Bot. Club 58: 434. 1931. TYPE: Venezuela. Amazonas: Cerro Duida, summit of Mt. Duida, Peak No. 7, 7,100 ft., Aug. 1928–Apr. 1929, *Tate 606* (holotype, NY; isotype, K).

Because the epithet *reticulata* was validly published in 1951 for a New Guinean species, a new name is needed. The new epithet relates to the position of the flowers and was introduced by Mrs. Splithof-Heerschop in her unpublished study of Araliaceae in the Guianas, carried out at Utrecht.

Additional material of *S. sessiliflora* has been collected in the last decade, and its variability can now be more effectively assessed. Two collections should, however, be excluded from the list of exsic-

catae presented under *S. reticulata* in Maguire et al. (1984): *Steyermark 98138* and *Steyermark et al. 109690*. Both of these are *S. steyermarkii*. To be added is *Steyermark et al. 124075* from Cerro Marutani, previously cited under *S. reticulata* subsp. *jauaensis*.

The resulting distribution pattern appears irregular, but may reflect reliction. Two populations are disjunct from the main center in the central-southern tepui region (Huber, 1988), which ranges from Cerro Parú to the Duida group. One of these is on or near Cerro Marutani in the Sierra Pakaraima, in the far south of the central-eastern region; and the other is at Auyán-tepui in the eastern region. The leaflets in the first are comparatively large, while the latter differs in fruit. The variability in the central area is phenotypic, most evidently in vegetative features.

Schefflera steyermarkii Frodin, sp. nov. TYPE: Venezuela. Bolívar: Cerro Jaua, cumbre, at base of second waterfall, 1,922–2,100 m, 22–27 Mar. 1967, *Steyermark 098138* (holotype, NY; isotypes, K, VEN not seen).

Arbores ad 10 m altae; haec species cum *Schefflera sessiliflora* hactenus confusa sed ab ea foliolis angustioribus apicibus acutis venis tenuibus et capitulis minoribus (ad 5 mm diametro) differt. Foliola pagina inferna argentea.

Tree 8–10 m tall, mostly glabrous; branchlets stout, 1.3 cm diam. Leaves around 10-foliolate; petiole ca. 26 cm long, arising from base 0.5–1 cm above its insertion, the free ligular portion ca. 1.5 cm long, with papery margins; petiolules around 2.4 cm long. Blades narrowly elliptic, glabrous, 7–13 cm long, 2–4.5 cm wide, thinly coriaceous; apex narrowly acute, passing ± insensibly into a caudate-acuminate tip to 1.2 cm long, lower part narrowing, base abruptly rounded but not recurving into petiolule, margins incorporating a marginal vein, vertically slightly wavy and sometimes slightly tucked in at vein endings; upper surface dull, undersurface minutely glandular-papillate, furnishing when dry a dull metallic reflection; midrib somewhat prominent below; lateral veins closely spaced, the primary veins 12–14 or more, spreading and extending to margin, the secondary veins closely resembling them but only reaching some ¾-way to margin, visible reticulation coarse. Inflorescence terminal, twice compound, paniculate; main axis 6.5–7.5 cm long, 0.8–1 cm diam., the zone of proliferation in the upper 3–4 cm; primary branches tightly clustered, 10 or more, rather straight and rigid, 35–43 cm long, 3.5 mm diam. near base, dull purple, subtended by bracts 3.5–4 cm long; capitula numerous, ca. 5 mm diam. after anthesis, 10–12-flowered, racemosely arranged, their peduncles 10–14 mm long, appressed silvery hairy, subtended by bracts 1.5–3 mm long (but where empty in lower part of branches to 6–7 mm long); buds dull purple with green; calyx silvery hairy below, the rim with 5 small teeth; petals and stamens 5; ovary 2(3)-locular, tawny yellow, disk ca. 1.3 mm across, stylar column ca. 1 mm long, tapering. Fruit not known.

The narrow leaflets of *Steyermark 98138* were noted by Maguire et al. (1984: 57) in introducing the records listed for *S. reticulata* (= *S. sessiliflora*). An earlier judgment by the author that a distinct species might be involved has, on the other hand, been given support by a second collection, *Steyermark 109690*. The two collections are thus here described as new. Other features that support the distinction of *S. steyermarkii* from *S. sessiliflora* include the finer leaflet venation and heads only about 5 mm diam. after anthesis. The relatively large number of primary branches in the inflorescence also appears to be distinctive; only *S. paruana* has more, and that species differs in leaflet form and morphology and in having flowers in umbellules.

Schefflera steyermarkii is limited to the Meseta de Jaua, which, with neighboring Cerro Sarisariñama and Cerro Guanacoco, is home to a number of other endemics in its series (*S. clausa*, *S. contracta*, and *S. jauaensis*) as well as, from among compound-umbellate species, the distinctive *S. gracillima* Steyermark & Maguire. All have been found in the summit zone. When compared with other tepui regions, however, endemism in the group seems low; other species are *S. coriacea*, here at its western limit, and *S. montana* (Gleason) Maguire, Steyermark & Frodin, otherwise occurring further west. *Schefflera sessiliflora*, too, is apparently absent, unless it has been overlooked.

Paratype. VENEZUELA. **Bolívar:** Cerro Jaua, cumbre, E tributary Río Marajano, 1,810–1,880 m, 28 Feb.–3 Mar. 1974, *Steyermark et al. 109690* (NY, US, VEN not seen).

Schefflera suaveolens Frodin, sp. nov. TYPE: Venezuela. Amazonas: Serranía Yutaje, Cerro Coro-Coro, Río Manapiare, 4,500 ft., 2 Mar. 1953, *Maguire & Maguire 35483* (holotype, NY). Figure 17.

Arbor sylvarum submontanarum usque ad 18 m alta, *Schefflerae psilophyllae* cognata autem ab ea ovario plerumque 4–5-loculari, foliolis tenuiter coriaceis (vel etiam chartaceis), et inflorescentiae radiis primariis fere semper verticillos subsidiaros radiorum secundariorum infra apicem 4–20 cm ferentibus recedit.

Tree 7–18 m tall, when young with as few as 3 orthotropic branches, in maturity with a rounded crown; adult twigs to 1.4 cm diam. below growing point. Adult leaves (3–)5-or 6(–8)-foliolate; petiole 12–28(–38) cm long (in ultimate leaves of a shoot relatively short), generally shorter than inflorescence branches, to 5 mm diam.; petiolules 1–6 cm long, widely varying within a given leaf. Blades oblong-elliptic to oblong-obovate, the widest point at or above middle, glabrous, 8–22 cm long, 3.4–8.4 cm wide, chartaceous to thinly coriaceous (when young at least sometimes membraneous), drying greenish with only slightly contrasting surfaces; apex acute to obtuse or rounded, tip absent or retuse, base acute to narrowly obtuse, with a mid-range of ca. 90° and shortly decurrent into the petiolule; margins ± wavy, not or only slightly inrolled; venation thin but distinct, spreading, ± ascending; primary and secondary lateral veins virtually indistinguishable, up to 40 on a side; subsidiary lateral venation variously developed. Blades in leaves from young plants smaller, narrowly elliptic or ovate, 7.5–10 cm long, 2.4–2.8 cm wide, the apex acute, the tip acuminate. Inflorescences compound, umbellate, all parts glabrous, initially terminal, later pseudolateral as new shoots develop from beneath and grow alongside; primary rays 3 or 4(5), 23–67 cm long, 3–7 mm diam., always or nearly always with a subsidiary whorl (occasionally 2 whorls) of secondary rays, the internode between apex and the whorl below it 6.5–13 cm; secondary rays 3–6(–7) cm long, the subtending bracts 4 mm long but largely becoming lost during fruit maturation, 10–20(–30) in terminal umbel (or just below it), ca. 6 in subsidiary whorl(s), often gently curving; ultimate coflorescences umbellate, comprising a central cluster of 10–12 bisexual, fertile flowers and about 2 or 3 irregularly spaced lateral umbellules arising at 2–12 mm below; pedicels in central cluster 8–11 mm long (lengthening slightly in fruit), each subtended by a persistent acicular bracteole; lateral peduncles 9–16 mm long with up to 10 (probably functionally male) flowers on pedicels 5–7 mm long; flowers glabrous, green in bud; calyx rim 0.75 mm wide, projecting outward above the ovary, the 5 teeth quite small; corolla pale, the petals 5, opening and spreading before falling; filaments 2 mm long; ovary (3-or 4-) 5-locular, oblong, 1 mm long, 0.8–0.9 mm across; stylar column 1 mm long, undivided. Fruit remaining wholly inferior, initially green, maturing red-purple and ultimately purple-black, ovoid to globose, 4–5.5 mm long, 4–5 mm across (but up to 8 mm across when fresh); calyx rim slightly projecting, the disk ca. 1.75 mm across; stylar column ca. 2 mm long, divided at the tip, its base filling most of the disk; pyrenes usually 5, sometimes fewer.

The first collection of this species was initially and tentatively identified with *Didymopanax spruceanus* by Gleason (1931); later it and other collections were placed by Maguire et al. (1984) in *Schefflera psilophylla*. The abundant material now available shows *S. suaveolens* not to represent either of these species. It can be distinguished from *S. spruceana* by the (3-)4-or 5-celled ovary and from *S. psilophylla* sensu stricto by the presence in the inflorescences of fewer primary rays, each with 1(2) subsidiary whorls of secondary rays in addition to those at the apex. The venation in *S. psilophylla* is also somewhat coarser and the leaflet apices are usually ± acute; moreover, the ovary is only 3-locular. From *S. myrioneura*, described above, the present species differs primarily in its less closely spaced lateral venation and more graceful, less angular-appearing inflorescences; from *S. umbraculifera* it differs mainly in having thinner, wholly glabrous leaflets with ± flat margins and finer, less strongly contrasting lateral venation.

Schefflera suaveolens has a relatively wide distribution from Serranía Yutajé and Serannía Uasadi south to the Neblina massif and its outliers and east to Auaris in the Serra Parima, and also a wide altitudinal range; it is described as occurring in montane forest, mixed mossy-forest, scrub forest and *Bonnetia* forest (sometimes along watercourses), and is occasional to frequent. Ecologically, it probably favors nutrient-rich soils with a steady water supply, and it may be opportunistic. When cut, it may yield an aromatic, transparent and sticky resinous exudate.

Paratypes. VENEZUELA. **Amazonas:** Serranía Uasadi, sector nor-occidental, cumbres montañosas ubicadas en las cabeceras orientales del Río Asita, afluente derecho del Río Ventuari, ± 1,850 m, 22 Nov. 1988, *Huber 12837* (K, MYF not seen); 8 km NW of Yutajé settlement, W of Serranía de Yutajé, 1,500–1,760 m, 4 Mar. 1987, *Liesner & Holst 21637* (MO); Agüita, slopes of Cerro Duida, 3,100 ft., Dec. 1928, *Tate 876* (NY); Cerro Marahuaca, "Sima Camp," S-C portion of forested slopes, 1,140 m, 22 Feb. 1985, *Steyermark & Holst 130506* (MO, NY); Cerro Marahuaca, summit on undulating plateau, 2,520–2,650 m, 26 Feb. 1985, *Steyermark & Holst 130750* (MO, NY); [Cerro de la Neblina:] Río Yatua, below NW escarpment between Camp 4 and Cumbre Camp, 1,700–2,000 m, 13 Jan. 1954, *Maguire et al. 37274* (K, NY); Cañon Grande, NW head, 2,000 m, 8–9 Dec. 1957, *Maguire et al. 42326* (K, MO, NY, US); Cañon Grande, NW head, 2,000 m, 8–9 Dec. 1957, *Maguire et al. 42327* (MO, NY); E Escarpment, upper Cañon Grande, 1,900 m, 14 Dec. 1957, *Maguire et al. 42406* (K, MO, NY, US); Caño[n] Grande

SSE of Cumbre Camp, 1,100–1,150 m, 26 Dec. 1957, *Maguire et al. 42520* (K, MO, NY, US); Pico Phelps, S face, S of Camp V, 1,550–1,650 m, 12 Apr. 1984, *Gentry & Stein 46579* (MICH, MO); Camp VII, 1,850 m, 3 Dec. 1984, *W. Anderson 13475* (MICH); Camp VII, 5 km NE of Pico Phelps, 1,800 m, 2 Feb. 1985, *Nee 30706* (MO, NY); Camp XI, 6 km NNE of Pico Phelps, 1,550–1,650 m, 27 Feb. 1985, *Nee 31161* (MO, NY); 26 km ENE of Base Camp [on S rim], ridge on border divide, 2,000 m, 15 Apr. 1984, *Plowman & Thomas 13612* (F, K, NY). BRAZIL. **Roraima:** upper slopes of Serra Parima, S of Auaris [Uavaris Valley], 4°03′N, 64°22′W, 1,400–1,520 m, 10 Feb. 1969, *Prance et al. 9801* (CGE, INPA not seen, NY, S, US). **Amazonas:** between Missão Salesiana and Serra Pirapucú, Rio Maturacá [SW of Neblina massif], 800–1,000 m, 23 Jan. 1966, *Silva & Brazão 60866* (K, NY).

Schefflera ulocephala Frodin, nom. nov. Replaced name: *Schefflera globulifera* Maguire, Steyermark & Frodin, Mem. New York Bot. Gard. 38: 69. 1984, not Grushvitzky & N. T. Skvortsova, 1969. TYPE: Venezuela. Amazonas: Cerro de la Neblina [N rim], in Cumbre Camp, 1,700–2,000 m, 23 Jan. 1954, *Maguire, Wurdack & Bunting 37354* (holotype, NY; isotype, K).

Because the epithet *globulifera* was validly published in 1969 for a Southeast Asian species, a new name is needed. The new epithet is based on the Greek *oulos*, curly or woolly, and *kephalos*, head.

Schefflera ulocephala is part of a series of six species, which on Neblina includes *S. pallens;* the other members are on Sierra de Maigualida and Serranía Uasadi, where there has been some local diversification, as yet little studied or documented. The species include *S. brachypoda*, *S. huberi*, and *S. longistyla* on Maigualida and *S. baculosa* on Uasadi. Of these, the last named most resembles *S. ulocephala*.

Schefflera umbellata (N. E. Brown) Viguier, Ann. Sci. Nat., Bot., sér. 9, 9: 367. 1909. *Sciodaphyllum umbellatum* N. E. Brown, Trans. Linn. Soc. Bot. ser. 2, 6: 32. 1901. TYPE: Venezuela [as "Guyana"]. Mt. Roraima, summit, Oct. 1898, *McConnell & Quelch 666* (lectotype, K; isotype, BM).

Schefflera umbellata subsp. *duidana* of Maguire et al. (1984) has been accorded specific rank in this paper and renamed *Schefflera acaropunctata*. Records from the western Gran Sabana, including Auyán-tepui and the Chimantá massif, are also described as a distinct, vicariant species, *S. clavigera*. *Cardona 1765* is also transferred to *S. japurensis*. As a result, *Schefflera umbellata* is now limited to the cluster of tepuis in the southeastern Gran Sabana centering on Roraima-tepui. Some variability exists among presently available material, but no attempt is made here to analyze it in more detail.

Additional specimens examined (not included in Maguire et al., 1984). VENEZUELA. **Bolívar:** Matahui-tepui [Kukenán-tepui], 2,700–3,000 m, 22 Aug. 1982, *Castillo 2716* (K); Kukenán-tepui, cumbre meridional, 2,700 m, 15 June 1985, *Huber & Alarcón 10552* (CM, MYF not seen, NY); Kukenán-tepui, summit, 2,550 m, 11 Apr. 1988, *Liesner 23139* (MO), summit, 2,550 m, 12 Apr. 1988, *Liesner 23164* (MO); Yuruaní-tepui, 12 km NNE of Kukenán-tepui, 2,200 m, 29 Feb. 1984, *Huber 9092* (MO, MYF not seen, NY, US); Mt. Roraima, SW slopes, 7,400 ft., 11 Jan. 1939, *Pinkus 153* (GH, NA, US); Mt. Roraima, on slopes among rift, headwaters of Great Central Rift, 2,700–2,740 m, 28 Sep. 1944, *Steyermark 58884* (F); Mt. Roraima, cumbre, NE part, 2,750–2,800 m, 26 Aug.–2 Sep. 1976, *Steyermark et al. 112445* (MO, NY, U); Roraima Peak, "am Abhang," Dec. 1909, *Ule 8704* (G, K, L).

Schefflera umbraculifera Frodin, sp. nov. TYPE: Venezuela. Amazonas: Sierra de Maigualida, sector NW, cabeceras del Río Iguana, afluente del Río Asita, on a SE-facing slope, 1,720 m, 25 Mar. 1988, *Huber 12682* (holotype, K; isotype, MYF not seen). Figure 18.

Arbor sylvarum humilium exigua cujus foliola *Schefflerae suaveolentis* paginam supernam habent sed ab ea foliolis crassioribus ad marginem incurvatis ac ad paginam infernam molliter pubescentibus valde recedit. Foliola oblongo-obovata et late emarginata.

Tree 4–7 m, with broad, dense crown; twigs pithy, 1.4 cm across just below uppermost leaf and inflorescence. Leaves 5-foliolate; petiole ca. 21.5 cm long, the base as wide as the twig and forming flanges but not extending into a ligule; petiolules 2.3–3.8 cm long. Blades oblong-obovate, glabrous above, pale green and minutely brownish to grayish sericeous-tomentose below (except on the paler primary and, to a lesser extent, secondary veins), 11.3–14.2 cm long, 6–6.6 cm wide, coriaceous, little varying in size within a given leaf; apex emarginate, base broadly acute, slightly recurved into the petiolule, margin entire, noticeably incurved when dry; upper surface glossy, the venation slightly recessed; undersurface with prominent but rapidly fading midrib and slightly raised venation; primary lateral veins 9–12 on each side, spreading, sometimes divaricating in outer part of blade, curving sharply near margin and passing up just inside it to anastomose with the vein above; secondary veins ± distinctly developed; cross-veins usually 1 or 2 on each side, passing from one primary or secondary vein to another at an angle of ca. 90° with the midrib. Inflo-

rescence initially terminal, later pseudolateral, umbellate, three times compound, without persistent bracts; main axis not developed; primary rays ca. 48.5 cm long, minutely and thinly sericeous-puberulent, their number unknown but presumably not more than 5 or 6; secondary rays 6.2–8 cm long, radiating hemispherically at ends of primary rays and outwards in a subsidiary whorl of 4 at ca. 12 cm below, with an occasional extra in between; ultimate coflorescences tertiary, with central bisexual, fertile flowers on pedicels 8–9 mm long at ends of secondary rays and 6–8 lateral, tertiary, 6–8-flowered umbellules arising from 2 to 23 mm below (the interval much more pronounced in the subsidiary whorl, relatively small among the terminal secondary rays), the peduncles and pedicels of the latter respectively 1.4–2 cm and 4–5 mm long, minutely sericeous-puberulent, the pedicels each subtended by a minute bracteole; ovary obconic, 1 mm long, the disk flat, the stylar column 1 mm long. Maturing fruit at ends of secondary rays becoming black, globose, 5–5.5 mm long, 5 mm across, angular when dry, the calyx rim minute, the disk 2–2.5 mm across, narrow, soon rising into a slender stylar column 2–2.5 mm long, the uppermost part 3–5-fid; fruit on lateral peduncles green, immature, 2.5–3 mm long.

Schefflera umbraculifera is superficially closest to *S. suaveolens* but differs most markedly in its leaflets, which are glabrous above but entirely pubescent beneath except for the main venation. Also, the secondary venation is not as strongly developed, the leaflets are thicker, and the inflorescence internodes are longer. *Schefflera neblinae*, with which the type collection was initially identified, and *S. varisiana* both have smaller, narrower leaflets with more or less whitish undersurfaces and smaller inflorescences with trilocular ovaries.

Schefflera umbraculifera is known only from the type collection and has been noted as frequent in shrubby vegetation of upper headwaters, at least some of it secondary.

Schefflera varisiana Frodin, sp. nov. TYPE: Brazil. Roraima: upper slopes of Serra Parima, S of Auaris [Uavaris Valley], 4°03′N, 64°22′W, 1,400–1,520 m, 10 Feb. 1969, *Prance, Steward, Ramos & Farias 09796* (holotype, K; isotypes, CGE, F, NY, US; A, INPA, MG, R, S, U, & VEN, not seen).

Arbor parva *Scheffleram neblinae* simulans, sed haec species nova foliis, 6–7-foliolatis, foliolis anguste obovatis vel obovato-ellipticis ad basin plus minusve attenuatis, paginae infernae venis prominulis a mesophyllo discrepantibus notabilis.

Tree to 8 m high, 12 cm diam. Leaves 6- or 7-foliolate; petioles 15.5–16.5 cm long, the sheathing base small; petiolules 1.8–2.5 cm. Blades narrowly obovate to obovate-elliptic, usually broadest above middle, the surfaces contrasting, 9–12.3 cm long, 3.2–5 cm wide, coriaceous, brittle when dry; apex obtuse to rounded, tip not present, base attenuate to acute, slightly decurrent at insertion of petiolule, margin narrowing from ⅓–⅔ of the way down from apex, incurved but not noticeably inrolled when dry; upper surface glabrous, the venation ± impressed, undersurface whitish or grayish sericeous, the indumentum tightly appressed, the venation somewhat raised in dry state and contrasting with the mesophyll; midrib prominent below; primary lateral veins ca. 12–16 on a side, ± closely parallel, near margin suddenly anastomosing and forming a submarginal vein; secondary venation ± well developed; reticulation fine, irregular, visible mainly on upper surface, with a few cross-veins. Inflorescence terminal, umbellate, twice compound; primary rays ca. 16.5 cm long, their number not known; secondary rays both at apex and in a single subsidiary whorl, ca. 20 at the former, far fewer in the latter; all axes sericeous-puberulent, the hairs much appressed, later glabrescent; umbellules 10–15-flowered, the pedicels slender, 5–6 mm long, sericeous-puberulent; flowers brown, in bud 3 mm long; petals 5, in bud sericeous without, at anthesis spreading outwards before falling; ovary 3-locular, the stylar column united, 0.5 mm long. Fruit not known.

Schefflera varisiana is closely related to *S. neblinae* and appears to be a sister species. From its sibling it differs in its narrowly obovate to obovate-elliptic leaflets, attenuate to acute leaflet base, better developed secondary venation, and particularly the leaflet surfaces: here the upper surface is more evidently rugose and the venation below is more prominent and shows greater contrast. In *S. neblinae* the leaflets are oblong-obovate to oblong-elliptic, the base of the blade is more or less rounded at its insertion with the petiolule, and the blades have less well developed secondary venation and relatively featureless surfaces. The pattern of differences of *S. varisiana* with *S. coriacea* is discussed under *S. neblinae*.

Schefflera varisiana is known only from the type collection and occurs in higher parts of the northern Serra Parima, in scrub forest. The locality is further described in Huber et al. (1984). It is about 375 km from Pirapucú, the type locality of *S. neblinae*, where on its upper slopes at 1,300 m similar forest might be expected.

The epithet is derived from the name of the valley in which Auaris, the type locality, is situated. The initial "ua" has been omitted in the interests of euphony.

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A New Species of *Galaxia* (Iridaceae subfamily Iridoideae) from Namaqualand, South Africa

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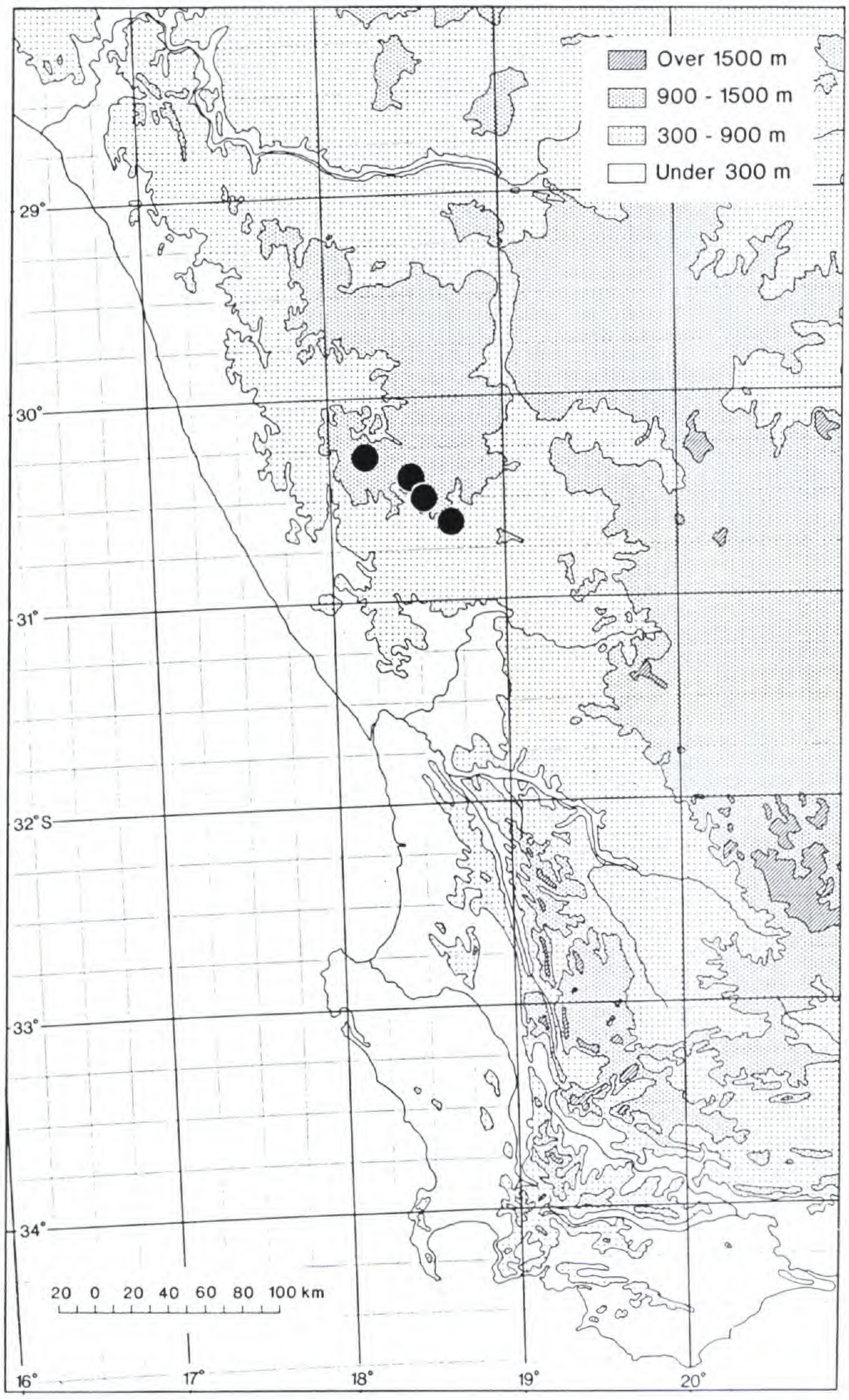
ABSTRACT. *Galaxia fenestralis* is new a species from central interior Namaqualand, Cape Province, South Africa. Apparently most closely related to another Namaqualand endemic, *G. kamiesmontana* Goldblatt, *G. fenestralis* is distinguished by its terete, succulent leaves, and small light pink to mauve or whitish flowers with a yellow center and narrowly clawed tepals. It grows on exposed granite outcrops in virtually no soil, and flowers early in the rainy season, in June and July, a few weeks after the first of the season's rains have fallen.

Comprising some 15 species, including the one described here, *Galaxia* Thunberg is restricted to the winter rainfall region of the southern and western Cape Province, South Africa (Goldblatt 1979a; 1984). A member of subfamily Iridoideae tribe Irideae (Goldblatt, 1991), *Galaxia* is distinguished from the related genera *Moraea* Miller and *Homeria* Ventenat by the absence of an aerial stem and by the cup-shaped flowers borne above the basal cluster of leaves on a short closed perianth tube. Two subgenera are currently recognized in *Galaxia* (Goldblatt, 1979a). Subgenus *Galaxia* comprises species with yellow or white flowers and apomorphic style lobes that are deeply and regularly fringed. In subgenus *Eurystigma* the flowers may be yellow but are more often pink to purple or reddish (also sometimes white), and the style lobes have entire margins, the plesiomorphic state. The new species, *G. fenestralis* (Figure 1), clearly accords with subgenus *Eurystigma* both in flower color and stigma features. Its flowers resemble most closely those of the only other Namaqualand member of the subgenus, *G. kamiesmontana* Goldblatt, in their pale pink to mauve color with a yellow center, small size, and in the rather narrowly clawed tepals. In other species of the subgenus the distinction between tepal limb and claw is obscure if present at all, and the flowers are considerably larger.

Cytologically, subgenus *Eurystigma* is notable for a descending dysploid series. The presumed ancestral basic chromosome number for *Galaxia* is $x = 9$ (Goldblatt, 1979b, 1984), also the base number for all species of subgenus *Galaxia* and for *G. kamiesmontana*. Other species of subgenus *Eurystigma* have $n = 8$, 7, or 6. Unfortunately, chromosome number has not been determined for the new species, the only member of the genus for which this information is unknown.

Galaxia fenestralis is distinguished by apomorphic nearly terete and succulent leaves with an adaxial band of transparent tissue (Fig. 2A). It is also unique in the genus in having the inner whorl of tepals connate for 2 mm with the filament column (Fig. 1B). Nectaries are present at the base of the outer tepals and can be recognized by their crescent shape and maroon edges (Figure 1B). Nectaries have not been described in other species of *Galaxia* (Goldblatt, 1979a), but perigonal nectaries are typical of tribe Irideae (Goldblatt, 1990) where they commonly occur at the base of the outer tepals, as in *Moraea* and *Iris* (Goldblatt, 1991), or also at the base of the inner tepals. The short-lived flowers, which last from mid-morning when they open until about 3:30 PM, are typical of the genus. Such fugacious flowers are plesiomorphic for subtribe Homeriinae, to which *Moraea* and *Homeria* also belong (Goldblatt, 1990, 1991).

The unusual leaves of *Galaxia fenestralis* (Figure 2A) are interesting anatomically. Although nearly terete, they are not centric. The peculiar transparent band on the upper leaf surface lacks chlorenchyma and is continuous with the cortical mesophyll, which is compact and lacks intercellular air spaces, which renders the leaf succulent. The "window" is bordered by single strands of subepidermal sclerenchyma fibers three cell layers thick. Elsewhere the epidermis overlies a palisade mostly of 3 cell layers. The outer walls of the epidermal cells are micro-



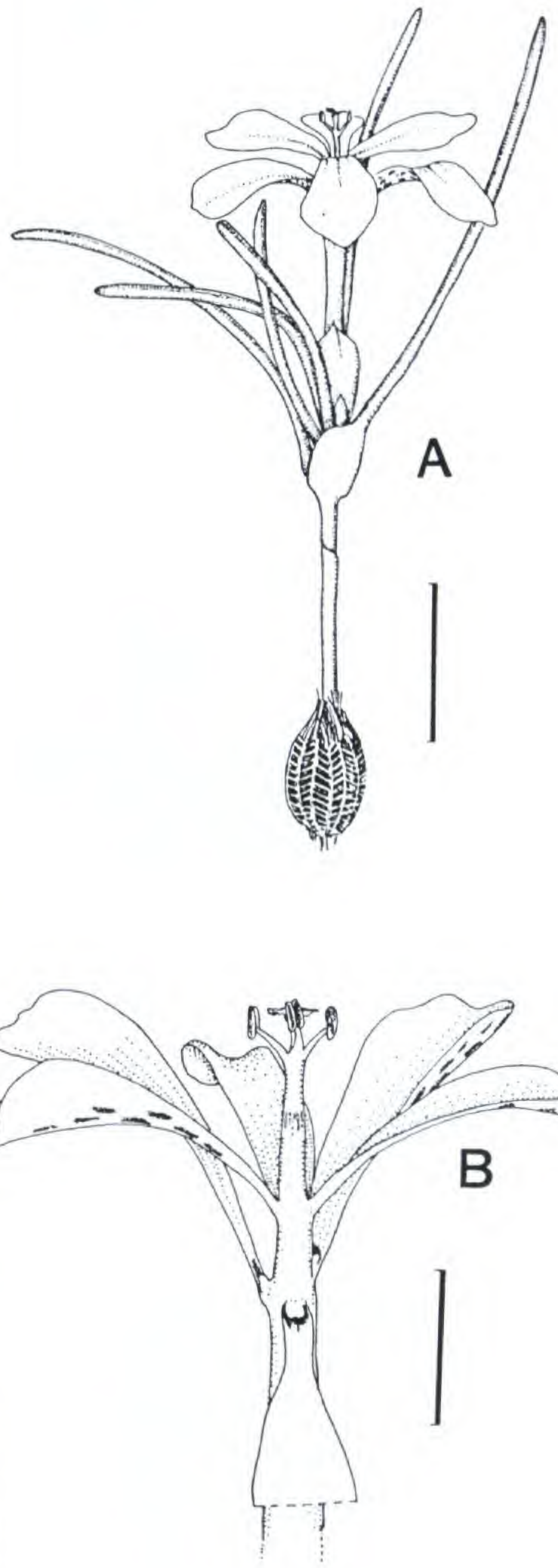


Figure 1. Morphology and distribution of *Galaxia fenestralis*. —A. Whole plant (scale bar = 2.5 mm). —B. Detail of flower with outer tepal bent forward to show basal nectary surrounded by dark pigment and entire filament column (note inner tepals united for a short distance with the filament column) (scale bar = 5 mm). (Drawn by I. Oliver.)

scopically striate, with two striae per cell. The outer walls and cuticle are otherwise unremarkable. Stomata are abundant above the chlorenchyma (absent from the "window"), are not sunken, and communicate with the cortex via substomatal chambers. The vascular bundles are arranged in a ring along the inner edge of the palisade with the xylem internal. A complete parenchymatous outer bundle sheath is present. The cells at the poles, especially at the phloem pole, each contain a single large rhomboidal crystal. The inner sheath is partially sclerified. A sclerenchymatous phloem cap is present on all but the most minor bundles, and an incomplete xylem cap is found on only the major bundles. The leaf of *Galaxia kamiesmontana*, putatively the closest relative of *G. fenestralis* is similar in its general anatomical features (Figure 2B), but it is much more slender, lacks the adaxial window, and is not succulent.

The leaves of *Galaxia kamiesmontana* and *G. fenestralis* are typical of malacophylous xeromorphs in their more or less terete shape with vascular bundles arranged in a cylinder, their compact mesophyll, and relatively greater amount of photosynthetic tissue in relation to the amount of exposed leaf surface (Eames & McDaniels, 1925). The abun-

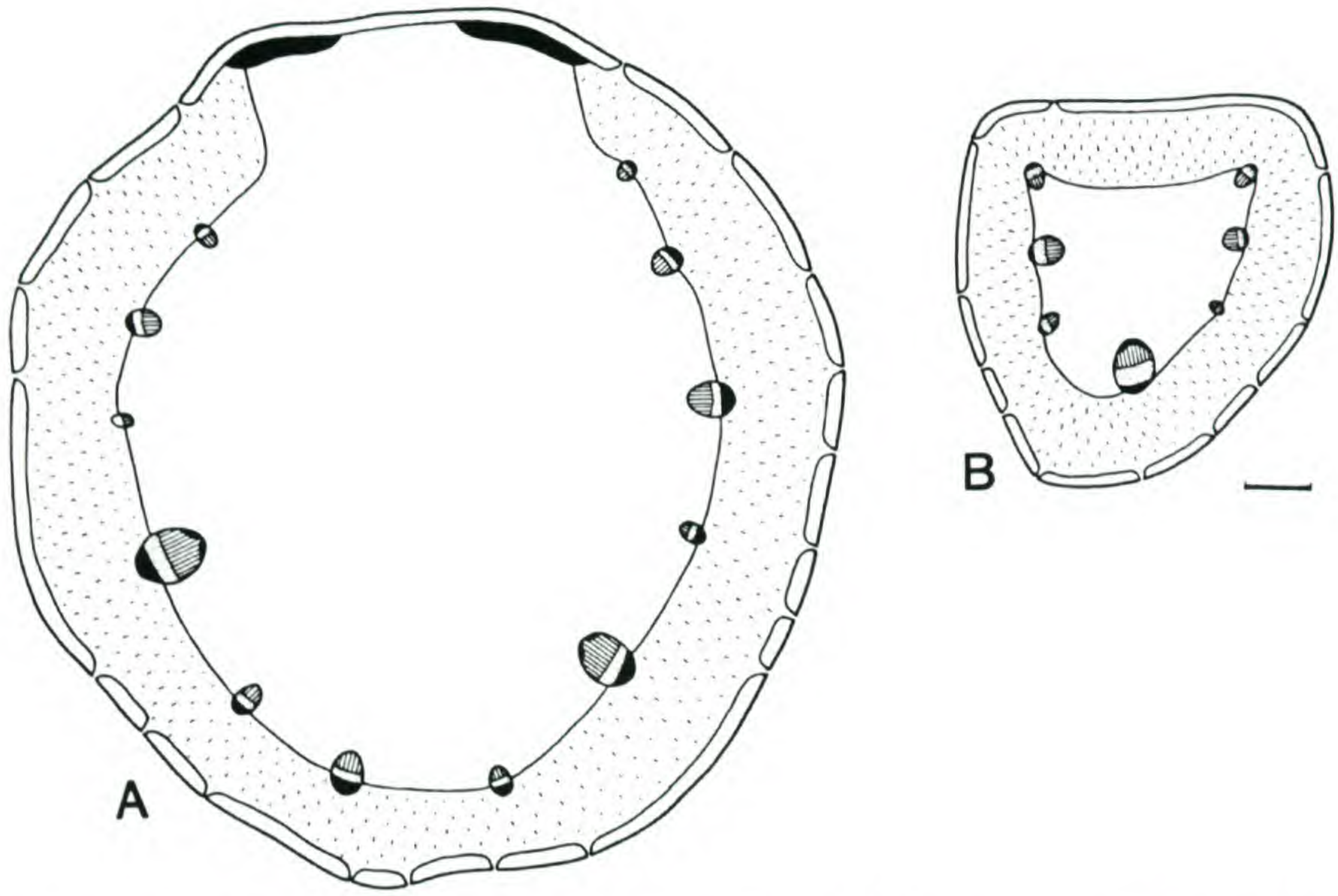


Figure 2. Leaf anatomy of *Galaxia fenestralis* (A) and closely related *G. kamiesmontana* (B) (scale bar 0.1 mm). (Drawn by J. C. Manning.)

dant surface stomata, unremarkable epidermis, and thin cuticle argue against significant drought tolerance. In *G. fenestralis* the strategy of maximizing photosynthetic tissue while minimizing surface area is apparently developed further through enhancing light utilization by the photosynthetic window which permits light to penetrate into the center of the leaf. This is presumably a strategy to enable rapid growth in the short period when water is available each growing season, followed by drought avoidance through geophytism.

Galaxia fenestralis Goldblatt & E. G. H. Oliver, sp. nov. TYPE: South Africa. Cape Province: 3018 (Kamiesberg) Kliprand District, valley northwest of Matjesfontein towards Middelpos, sandy seep on low granite outcrop, 960 m, 27 June 1991 (DA), *Oliver 9847* (holotype, STE; isotypes, K, MO, PRE) (Figure 1).

Plantae parvae, ad 2.5 cm altae, foliis productis 3–4, laminis teretibus falcatis succulentis 10–35 × 0.6–1 mm, floribus cupuliformibus pallidis carneis ad malvinis vel albescentibus centribus luteis, tubo perianthii ca. 8 mm longo, tepalis unguiculatis ca. 15 mm longis, unguibus tepalorum interiorum ad columnam filamentorum connatis, limbis patentibus, filamentis ca. 7 mm longis in columnam connatis supra divergentibus, antheris ca. 2 mm longis, stylo diviso prope medium antherorum, marginibus stigmatum integribus undulatis.

Plants small, to 2.5 cm high. *Corm* ± ovoid, 6–8 mm diam., the tunics light brown, composed of reticulate fibers with prominent vertical ribs. *Foliage leaves* 3–4 per plant, blades terete, falcate, succulent, 10–35 × 0.6–1 mm, with a transparent adaxial band, the sheaths broad and transparent. *Stem* subterranean but in fruit reaching shortly above the ground. *Flowers* actinomorphic, cuplike, pale pink to lilac (or whitish) with a yellow center; *perianth tube* ca. 8 mm long, cylindric; *tepals* ca. 15 mm long, unguiculate, the inner 3 tepals joined to the filament column for ca. 2 mm, tepal claws ascending, ca. 6 mm long, the limbs spreading, ca. 6 mm long. *Filaments* ca. 7 mm long, united for the lower 6 mm in a cylindrical column (connate for 2 mm with the inner tepals), free and diverging above; *anthers* ca. 2 mm long, erect, yellow. *Ovary* ca. 4 mm long; *style* slender, reaching to about mid anther level, there diverging into 3 lobes, these with entire, undulate margins. *Capsules* ovoid-ellipsoid, ca. 6 mm long; *seeds* ± globose, ca. 0.6 mm diam., dark brown.

Flowering June but depending on the advent of rain (probably until mid July); flowers normally opening ca. 10:00 hr. and collapsing ca. 15:30 hr.

Distribution and habitat. Galaxia fenestralis is endemic to the eastern Kamiesberg Mountains of central Namaqualand and to the lower hills of the interior in the Kliprand District (Figure 1). It was discovered only in 1990 and its entire range remains to be demonstrated. Like the apparently closely related *G. kamiesmontana*, *G. fenestralis* favors rocky habitats where it grows in shallow sandy soil on exposed granite outcrops. It flowers at the beginning

of the wet season when these sites remain damp for a few weeks and are sometimes waterlogged. In this basically very extreme habitat, which may dry out rapidly in warm weather, we surmise that the succulent leaves store enough water to permit plants to survive periodic desiccation of their habitat. The transparent adaxial window may serve as a means to increase light penetration into the inner tissues of the leaf so that photosynthesis is enhanced during the short periods when moisture conditions permit this to occur.

Paratypes. SOUTH AFRICA. **Cape:** 3018 (Kamiesberg) Leliefontein Communal Area, valley southeast of Gooimanskraal between Paulshoek and Nourivier, shallow sand in seep on granite sheets, 1,130 m, 28 June 1991 (AC), *Oliver 9858* (STE); Platbakkies, plateau northwest of Banke, seeps and damp sand on granite sheets, 1,100 m, 28 June 1991 (AD), *Oliver 9852* (PRE, STE); Kliprand District, between Wabreek and Middelpos, 1,080 m, 27 June 1991 (BC), *Oliver 9849* (STE); hill slopes 4 km southwest of Kliprand, on Rietmond road, south-facing granite slabs, 960 m, 27 June 1991, *Oliver 9846* (STE); 7.5 km southeast of Kliprand on Kamas road, south-facing slopes on granite, 840 m, 5 July 1990 (fr), *Oliver 9510* (STE), 27 June 1991 (DB), *Oliver 9844* (MO, PRE, STE).

Acknowledgments. We thank John Manning for assistance with the leaf anatomical study, and Inga Oliver and John Manning for the illustrations used here.

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Ruptiliocarpon (Lepidobotryaceae): A New Arborescent Genus and Tropical American Link to Africa, with a Reconsideration of the Family[1]

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ABSTRACT. A new genus and species of trees from Costa Rica and northern South America, *Ruptiliocarpon caracolito*, is described and compared to the African *Lepidobotrys*. It is distinguished from *Lepidobotrys* primarily by its much shorter filaments, basifixed rather than versatile anthers, its lack of styles, its two-rather than three-locular ovary, and by its irregularly dehiscent fruits with a woody exocarp and cartilagineous endocarp. In wood anatomy, apart from the presence of vestured pits in *Ruptiliocarpon*, the two genera are remarkably similar. They match in important floral and fruit characteristics (dioecious; 5 + 5 stamens of unequal length with filaments fused at base; two apical, collateral ovules per locule; one-seeded fruit; black seed with a large red aril and no endosperm), and both have unifoliolate leaves with very fugaceous stipules and stipels, and leaf-opposed inflorescences. The familial placement of *Lepidobotrys* has been controversial: the genus was placed first in the Linaceae by Engler, then in the Oxalidaceae by Hallier, then in its own family (between Linaceae and Erythroxylaceae) by Léonard, and then again in the Oxalidaceae by Cronquist. Reviewing evidence, old and new, we maintain *Ruptiliocarpon* and *Lepidobotrys* (only) in the Lepidobotryaceae and suggest that they relate more to Sapindales or possibly Euphorbiaceae than to Oxalidaceae.

Populations of Cedro caracolito, a local name for the new taxon described below, lay hidden and protected in Costa Rica's Osa Peninsula until recently built roads exposed the area to easy access for botanical exploration and the process of deforestation. There, caracolito is a large, locally common tree with light wood having good qualities for cabinet work, but it is not generally known or sought by wood harvesters. Ongoing investigations of bark extract show that it has promise as a biocide (natural-product agricultural pesticide, Arnason, pers. comm.). Several earlier collections of *Ruptiliocarpon* from South America (most of them filed among the Fabaceae) have come to light since its discovery in Costa Rica. Study of the flowers led us to search among the Sapindales (Cronquist, 1981) and, following submission of an earlier draft of this paper, we distributed numerous Costa Rican collections (including the type) with the new name but placed in Meliaceae. Bringing together information on wood anatomy, floral anatomy, embryology, and pollen morphology, we were later convinced to describe it as a new family. Finally, we saw it to its proper home as a distinct new genus of the hitherto monotypic Lepidobotryacaeae, itself of controversial relationships. The novelty, problematic placement, and economic potential of *Ruptiliocarpon* underscore the urgency of continued exploration, study, and protection of tropical floras.

Ruptiliocarpon caracolito Hammel & N. Zamora, gen. et sp. nov. TYPE: Costa Rica. Limón: Cordillera de Talamanca, Cantón de Matina, cuenca media del Río Barbilla, margen izquierda, sendero entre Cerro Amú siguiendo la fila hacia el este hasta estribaciones del Cerro Tigre, 200 m, 9 Nov. 1988 (fr), *Herrera & Martínez 2310* (holotype, CR; isotypes, AAU, BM, CAS, COL, DUKE, F, G, GB, K, KYO, LE, MEXU, MICH, MO, NY, PMA, QCA, QCNE, RSA, S, TEX, UC, US, USJ, VEN, WIS).

Lepidobotrys similis sed inflorescentiis et floribus masculinis femineis similibus, antheris basifixis antisepalis ses-

[1]The usual editorial policy of *Novon* only to allow papers that present new taxa has been relaxed for the two following papers (Mennega, Tobe & Hammel); each was written in concert with and designed to be published with the core paper in which a new genus is described.

silibus, antipetalis in filamentis parvis, ovario biloculari, stylis quasi nullis, stigmatibus 2, capsulis exocarpio lignoso ruptili differt.

Dioecious, evergreen trees 20–30(–40) m tall, (20–)50–90 cm DBH; bole straight, smooth and branch-free for the lower ca. 15 m, light gray with large scattered lighter and darker patches; bark with very shallow, narrowly lanceolate, longitudinal fissures, bitter; wood pinkish white, porous and light-weight. Leaves unifoliolate; leaflets elliptic, (5–)6.5–16 cm long, (2.7–)4–7.5 cm wide, entire, without pellucid lines or dots, without obvious fragrance, chartaceous, sparsely appressed-pubescent at the base with small simple trichomes, obtuse at the base, the apex acute to acuminate, the acumen ca. 1 cm long; lateral veins 5–7 pairs; reticulate venation obvious on the lower leaf surface; petiolule pulvinulate (thickened) for its entire length, 2–4 mm long with a distinct articulation at juncture with petiole and on emerging leaves, subtended by a slender clasping, deciduous stipel 4–5 mm long; petiole (0.4–)0.6–1.5 cm long, pulvinate at the base; stipules paired, ensiform, 1–1.5 mm long, soon deciduous, visible on emerging leaves and leaving minute, scarcely visible scars on the twigs. Inflorescence a lax, mostly leaf-opposed (terminal) panicle of spikes; peduncle 1–2 cm long; 1–3(–4) branches 2.3–8(–10) cm long, each with a small bracteole at the base; rachis puberulous. Flowers cryptically unisexual (the staminate with pistil but only rudimentary ovules, the pistillate with stamens but no pollen), globose to ovoid, 4–4.5 mm long, 3.5–4 mm wide, at anthesis opening only slightly, green, subtended by 3 rounded, abaxially sparsely puberulous, ciliate bracts 0.5–0.8 mm long; sepals 5, free, imbricate, ciliate, 1.6–2 mm long and wide; petals 5, free, imbricate, apically ciliate, 3–4 mm long, 2.5 mm wide. Stamens ca. 3 mm long (including filament tube), slightly shorter in female flowers than in male; filaments fused into a tube/nectary ca. 0.5 mm long; anthers 10, narrowly cordate, ca. 1(–1.2) mm long, inserted in 2 alternating series, the antipetalous at apex of filaments (ca. 0.5 mm long), the antisepalous ± sessile on the margin of the tube, rarely with a small, simple appendage produced on the margin of the tube between the anthers; connective produced to form a small pubescent appendage. Pollen tricolporate with no thickenings at apertures, subspheroidal, 10.5–15 μm (polar axis) × 11–16 μm (equatorial axis); exine variable (di-or polymorphous?), psilate or verrucate to fossulate/foveolate; amb triangular; colpi rather short with thin costae ca. 0.8–1.0 μm thick; pores sometimes slightly protruding, elongated along polar axis, ca. 2.5–4.0 μm; exine 0.8–1.0 μm thick, tectate, columellae hardly visible. Intrastaminal or gynophoreal nectary lacking. Ovary ± ovoid, ca. 1.5–4 mm, smaller in the male flowers than in the female, glabrous, 2-locular; each locule with 2 collateral ovules, pendulous from near the summit of the partition; obturator from funicular tissue present. Style essentially lacking, the summit of the ovary ± directly produced into an obscurely 2-lobed stigma. Fruit an ovoid 1(rarely 2)-seeded capsule, 2.5–3.5 cm long, 1.5–2.5 cm wide; exocarp coriaceous to woody, irregularly rupturing and falling away to expose 2 horny endocarps, one nearly completely surrounding the seed, the other usually empty and smaller, these also falling away, the larger taking on the shape of a snail shell. Seed globose, shiny black, ⅓ covered with a red-orange aril, pendulous (by the aril) at the end of a coriaceous strip (the partition) attached to the pedicel. Figures 1–3.

Paratypes. COSTA RICA. **Puntarenas:** Cantón de Golfito, steep forested slopes above Golfito Airstrip, 1–200 m, 19 Jan. 1984 (st), *Pennington et al. 11398* (CR); Reserva Nacional de Vida Silvestre Golfito, en fila entre Golfito y Villa Briceño, 200 m, 27 Jan. 1992 (fr), *U. Chavarría et al. 511* (CR, F, MO); Cantón de Osa, Reserva Forestal Golfo Dulce, entre Chacarita & Rincón, ca. 15 km de Chacarita, Alto los Mogos, 100 m, 27 Mar. 1991 (fl), *Aguilar & Hammel 101* (AAU, BM, CAS, COL, CR, DUKE, F, G, GB, K, KYO, LE, MEXU, MICH, MO, NY, PMA, QCA, QCNE, RSA, S, TEX, UC, US, USJ, VEN, WIS); ca. 4 km de Rincón, 230 m, 9 Nov. 1990 (st), *Hammel & M. M. Chavarría 17965* (CR, MO); antiguo campo de aterrizaje de Rincón, en fila al N de la Estación Agua Buena de Boscosa, 300 m, 28 Nov. 1990 (fr), *Hammel 17983* (CAS, CR, F, MO, NY, K, US, USJ, WIS); entre Rancho Quemado—por camino nuevo—y Drake, 50 m, 29 Mar. 1991 (imm fr), *Aguilar et al. 103* (CR, F, MO); 300 m, 20 Mar. 1991 (fl), *Hammel et al. 18154* (CR, F, MO); 300 m, 17 June 1990 (fr), *Herrera 4198* (CR, F, MO); 21 Mar. 1989 (fl), *Jiménez et al. 672* (CR); Fila Ganado, between Rancho Quemado—along old road—and Drake, 400 m, 5 June 1988 (fr), *Hammel et al. 17034* (CR, F, MO); entre Rancho Quemado—por camino nuevo de madereros—y Guerra, 300 m, 28 Mar. 1991 (fl), *Hammel et al. 18166* (CR, F, MO); Finca de Juan Marín, cerca a Guerra, 250 m, 6 Aug. 1991 (fr), *Marín 87* (CR, MO); Reserva Indígena Guaymí, ca. 2 km noreste de la unión del Río Pavón con Río Rincón, 100 m, 20 Oct. 1990 (fr), *Hammel et al. 17911* (CR, F, MO); San Pedrillo, Playa Campanario, 10 m, 27 Mar. 1991 (fl), *Harmon 210* (CR, F, MO). COLOMBIA. **Valle:** Bajo Calima, 15 km N of Buenaventura, 50 m, 26 Mar. 1986 (fr), *Gentry et al. 53632* (MO).

Etymology. The essence of caracolito's most characteristic feature is captured by combination of the Latin "ruptilis," irregularly splitting, with the Greek "carpon," fruit. We explicitly choose this hybrid word "Ruptiliocarpon," against recommendation of the *Code*, because we consider the purely Greek or Latin options decidedly inelegant (e.g.,

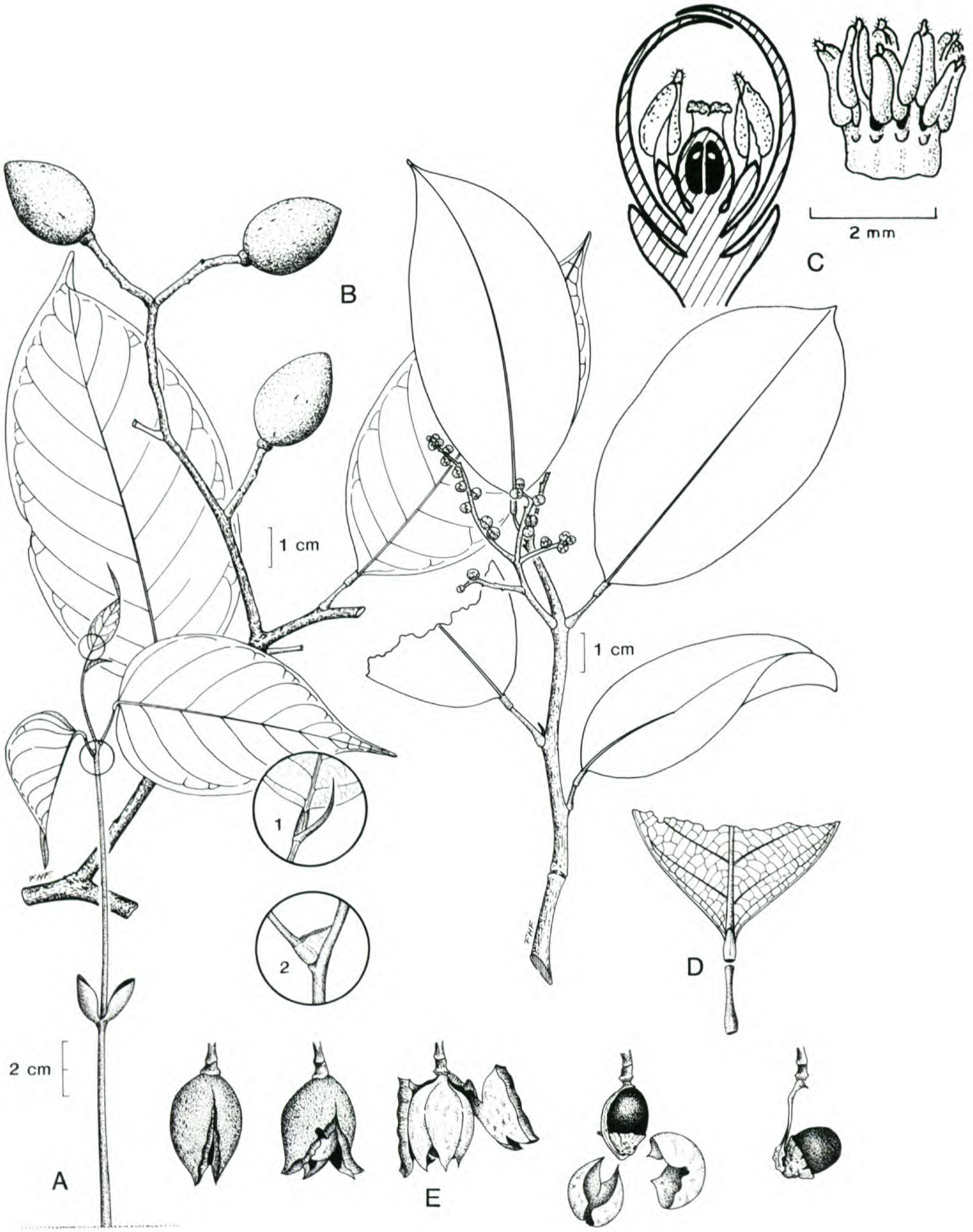
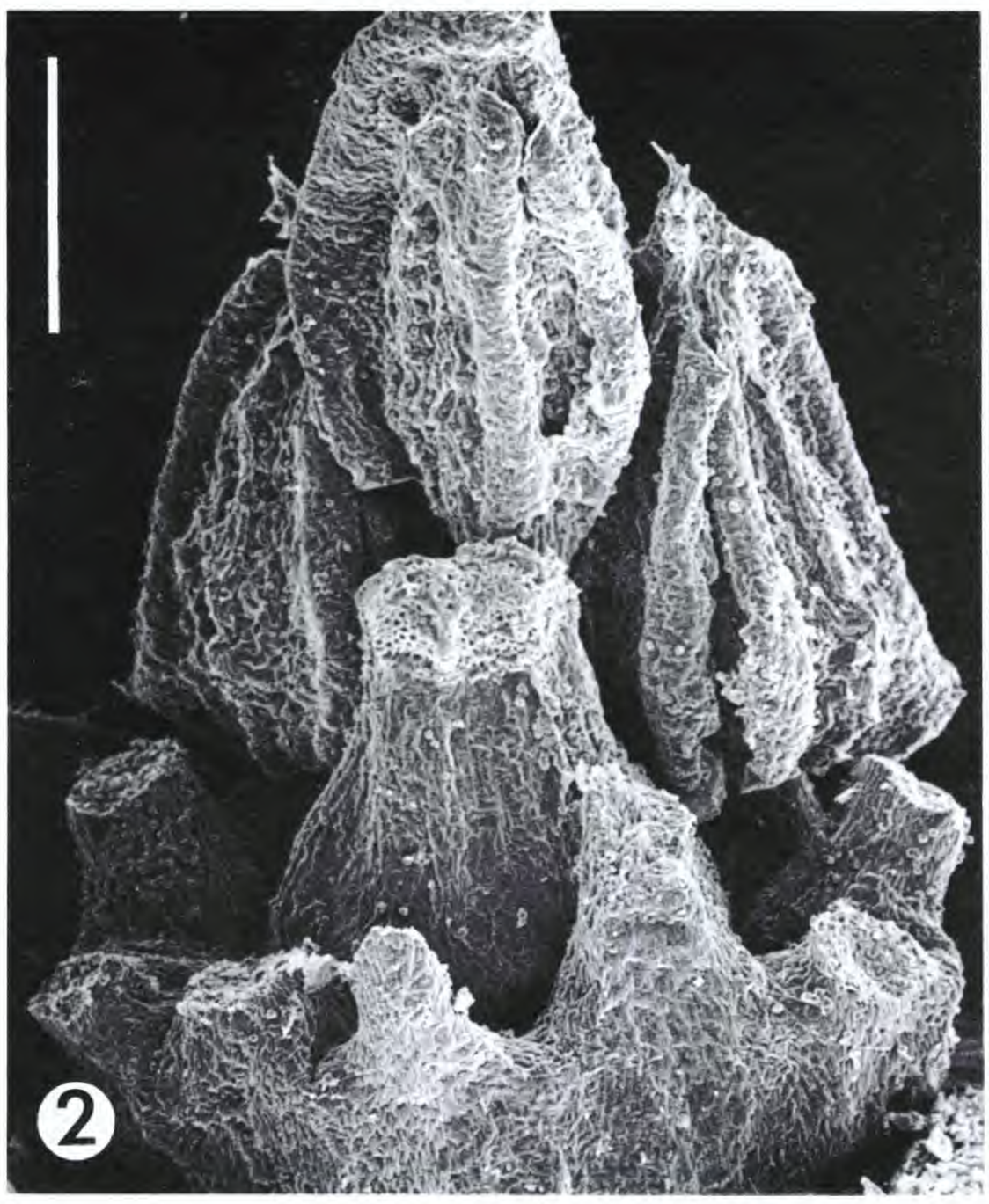
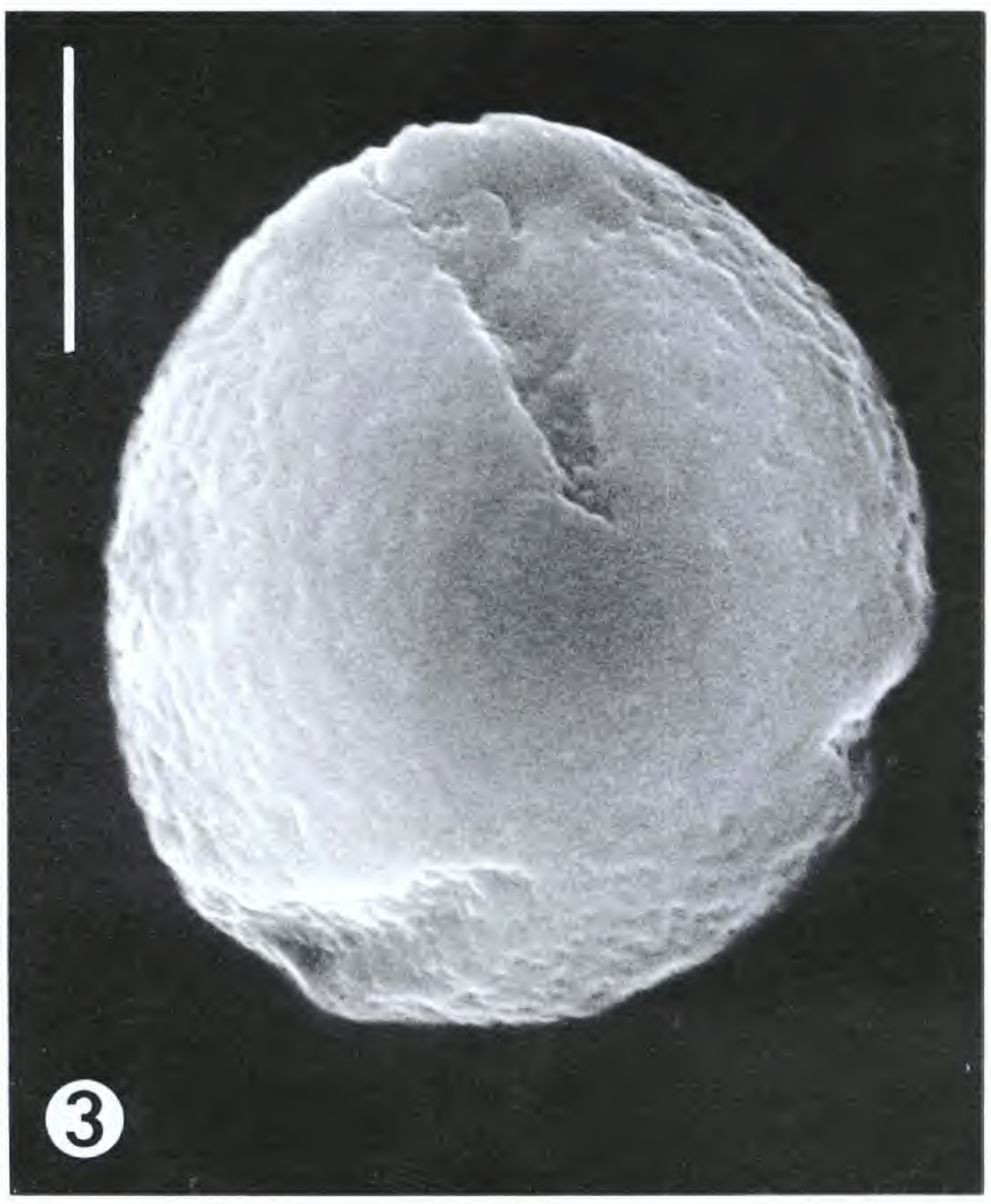


Figure 1. *Ruptiliocarpon caracolito* Hammel & N. Zamora. —A. Seedling with insets: 1-stipel, 2-stipule. —B. Fruiting and flowering branches. —C. Flower showing longitudinal section and androecium. —D. Articulation of leaflet. —E. Fruit dehiscence series. Flowering material from *Aguilar & Hammel 101*, other material from *Hammel 17983*.

"Ruptilifructum" or "Klastocarpon") by comparison. Likewise, we intentionally take "io" as the combining form rather than either "i" or "o" alone because it effectively and smoothly bridges the Latin/Greek chasm. The epithet "caracolito," meaning small snail, as in the shape of shell macaroni (also called "caracolito" in Spanish), is in reference to the shape of the fallen, horny endocarp and is taken





Figures 2, 3. Flower and pollen of *Ruptiliocarpon caracolito*. —2. Mature flower bud with perianth and seven anthers removed, showing staminal tube and ovary. Bar = 0.5 mm; *Hammel 18154*. —3. Pollen. Bar = 5 μm; *Harmon 210*.

directly from the common name (Cedro caracolito). As such, it assumes the gender of its genus, in this case neuter, without change. We clarify these origins so that well-meaning Latinists will resist correcting our spellings. In Costa Rica the common name "cedro" is used mostly—often in combination with a clarifying epithet—for species of *Cedrela*, *Carapa* (Meliaceae), *Calophyllum* (Clusiaceae), and *Tapirira* (Anacardiaceae). A common name for *Ruptiliocarpon* in Peru is Cedro masha (R. Vásquez, pers. comm.).

Phenology. In Costa Rica, *Ruptiliocarpon caracolito* flowers in late March to early April, directly following a flush of new leaves. The fruits are nearly mature by late December and last into February. By the time flowering begins, the previous year's crop of fallen seeds has germinated and grown to the third or fourth leaf. Apparently not all mature individuals flower in a particular year. However, we have found flowering individuals that had obviously flowered and fruited the previous season.

Germination. Seeds fallen below trees germinate readily *in situ*, and those taken from ripe fruits also germinate readily in pots; the radicle begins to emerge within ca. 2 weeks of planting. Germination is epigeal; the thick cotyledons are green and the first leaves are opposite. The first few seedling leaves are often reddish below and, in general aspect, are strikingly similar to those of *Protium aracouchini* (Aublet) Marchand (Burseraceae) and *Pterocarpus* spp. (Fabaceae).

Habitat and Distribution. In Costa Rica this often large tree is common on slopes and hills of the Osa Peninsula and nearby Golfito. We have found it near sea level but most often between 100 and 400 m elevation and always in well-drained primary forest, typically with red clay soils. It has also been collected from near Barbilla (the type locality) on the Atlantic slope. This transmontane, distribution between the Caribbean lowlands and the Osa Peninsula on the Pacific slope, is exhibited in Costa Rica by numerous other wet forest, basically South American taxa such as *Dendrobangia boliviana* Rusby (Icacinaceae), *Hirtella tubiflora* Prance (Chrysobalanaceae), *Humiriastrum diguense* Cuatrecasas (Humiriaceae), *Pleurothyrium trianae* (Mez) Rohwer (Lauraceae), *Qualea paraensis* Ducke (*Vochysiaceae*), and *Thoracocarpus bissectus* (Vellozo) Harling (Cyclanthaceae). On the basis of that pattern we had predicted the presence of the genus in South America. Now that it is known from Colombia, Peru, and Suriname, *Ruptiliocarpon* seems conspicuously absent from Panama and Ecuador.

In addition to the Colombian specimen, included among the paratypes, numerous other South American, mostly Peruvian, collections have also come

TABLE 1. Characters shared by *Ruptiliocarpon* and *Lepidobotrys*.

Leaves	unifoliolate with stipules, stipels and disarticulation at upper pulvinus
Inflorescences	leaf opposed
Flowers	unisexual; 5 imbricate, free sepals; 5 imbricate, free petals; 10 stamens with 5 longer and 5 shorter filaments; filaments fused at base into nectary/tube
Ovules	apical axial placentation, 2 collateral ovules per locule; placental obturator
Fruits	exocarp and endocarp separate; dehiscence septicidal
Seeds	black, one per fruit; orange aril at apex of fruit attached to tip of partition; endosperm lacking

to our attention. No flowering material from South America has been seen, but the observed variation suggests that more than one species may be involved. Therefore, we explicitly isolate the following South American collections of *Ruptiliocarpon* from those cited as *R. caracolito:* PERU. Loreto: 7 km SW of Iquitos, 31 July 1972 (fr), *Croat 18606* (MO); Maynas, Pucacuro, Río Chambira, 160 m, 20 Apr. 1986 (fr), *Vásquez et al. 7452* (MO); Maynas, Nauta, Carretera a Iquitos, 150 m, 8 Dec. 1986 (fr), *Vásquez & Jaramillo 8475* (MO); Maynas, Iquitos, Quebrada de Aucaya hasta Unión, 22 June 1976 (fr), *McDaniel & Rimachi Y. 20801* (MO); Maynas, Iquitos, Allpahuayo-IIAP, 150 m, Nov. 1990 (st), *Vásquez & Jaramillo 14820* (MO), Dec. 1990 (st), *Vásquez & Jaramillo 15543* (MO), (bud), *Vásquez & Jaramillo 15740* (MO), 22 May 1991 (fr), *Vásquez & Jaramillo 16314* (MO), 11 July 1991 (st), *Vásquez & Jaramillo 17366* (MO); Sapuena, Río Ucayali, 170 m, 2 July 1991 (fr), *Grández et al. 2732* (MO); Yanamono "Explorama Lodge," 120 m, 19 May 1979 (fr), *Diaz et al. 1140* (MO); 130 m, 26 June 1983 (st), *Gentry et al. 42185* (MO), 10 July 1983 (st), *Gentry et al. 42866* (MO). SURINAME. Nassau Mts., 530 m, 23 Mar. 1949 (st), *Lanjouw & Lindeman 2877* (U), 1955 (st), *Lindeman & Cowan 7020* (U).

The fact that *Ruptiliocarpon* (in spite of the large population at Golfito) was neither reported by Allen (1956) nor apparently collected in Costa Rica before 1984 may result, in part, from the inconspicuous nature (small green flowers) of the species. However, as with *Ticodendron* (see Hammel & Burger, 1991) the discovery of *Ruptiliocarpon* surely has more to do with a recent general upsurge in collecting efforts and, especially in Costa Rica, an intensive focus on collecting and classifying the large trees. We should also expect that more specimens from earlier collections, throughout the Neotropics, will now come to light.

Relationships. The section on relationships in earlier drafts of this paper focused on a search for a family for *Ruptiliocarpon* among the Sapindales. Due, in part, to a strong resemblance between the wood of *Ruptiliocarpon* and *Trichilia* (Mennega, 1993; R. Miller, pers. comm.; C. Morton, pers. comm.), but also because of floral similarities, most importantly, the filament tube, one earlier draft described *Ruptiliocarpon* as a new genus of Meliaceae. Another, bringing together information on wood anatomy, floral anatomy, embryology, and pollen morphology, presented it as a new family. Curiously, some 40 years earlier Léonard (1950) had come to this same conclusion after a similar, family-by-family, search (in part among Sapindales) focused on the African genus we now believe to be *Ruptiliocarpon*'s nearest relative.

The African (Gabon–Cameroon region) *Lepidobotrys* is a monotypic genus that has been variously compared or assigned to Linaceae (Engler, 1902), Oxalidaceae (Hallier, 1923; Cronquist, 1981), Lepidobotryaceae, Erythroxylaceae, and Sapindales (Léonard, 1950). *Ruptiliocarpon* and *Lepidobotrys* are nearly identical in their wood and leaves. Although floral and seed anatomy of *Lepidobotrys* have not been analyzed to the same detail as *Ruptiliocarpon*, the two genera coincide unambiguously in important floral and fruit characters, as well as in the unusual leaf-opposed position of inflorescences (Table 1). Specimens of them compared side by side immediately proclaim kinship from across the Atlantic Ocean. Here follows the history of why it took at least 40 years (after many millions) to make that comparison and get these two back together.

We first saw and recognized *Ruptiliocarpon* as problematic after collecting fruiting material in Costa Rica in 1988. As in nearly all examples of earlier collections and identifications from elsewhere that have come to light, the plant was soon determined to be a legume. Convergence among workers in identifying collections of *Ruptiliocarpon* as Fabaceae is remarkable. The earliest known collection (Suriname, 1949 (st), *Lanjouw & Lindeman 2877*) was placed provisionally at U in the "Papilionaceae" (Mennega, pers. comm.). The first known fertile collection (Peru, 1972 (fr), *Croat 18606*) was identified as *Swartzia simplex* (Swartz) Sprengel. Most other collections that have come to our attention had been identified as *Bocoa*, a papilionoid legume.

Although the fruits (immature) of our early collections, outwardly similar to those of species of *Cynometra*, were initially interpreted as drupaceous, the arillate seed was contradictory and suggested *Swartzia*. Furthermore, a scan through the Fabaceae material at MO revealed that the double pulvini, articulation of the leaflet, and overall appearance of leaf venation make caracolito look very much like a unifoliolate legume such as *Bocoa prouacensis* Aublet (we now know that some specimens of this species at MO were actually sterile, misidentified collections of *Ruptiliocarpon*), *Dalbergia monetaria* L.f., or *Swartzia hostmannii* Bentham. The discovery of stipules and stipels on seedling leaves further supported Fabaceae. As noted below, many of the wood characters of *Ruptiliocarpon*, including vestured pits, are also in accordance with that family.

However, once phenology and logistics finally coincided (in 1990), numerous flowering individuals were seen in the field, and flowers from five different collections were examined microscopically, it became clear that *Ruptiliocarpon* could not be a legume. The flowers, with a staminal tube/nectary, a compound, 2-locular ovary with 2 collateral ovules per locule and apical axial placentation, decisively eliminate the Fabaceae and would seem to place the new taxon within the Sapindales of Cronquist (1981). These and other floral characters give *Ruptiliocarpon* a resemblence to Meliaceae, although the secretory nature of the staminal tube would appear to be discordant in that family (Tobe & Hammel, 1993). Pollen morphology characters of *Ruptiliocarpon* are also discordant in Meliaceae because the characteristic (for Meliaceae) apertural thickenings are not present in *Ruptiliocarpon* (Hooghiemstra, pers. comm.).

Although the wood of *Ruptiliocarpon* is very similar to *Trichilia* (Mennega, 1993) one important feature, vesturement of the vessel pits, which was discovered late in this analysis and reconfirmed with SEM, does not coincide with *Trichilia* nor with any other Sapindales and adds to the list of characters that isolate *Ruptiliocarpon* from Meliaceae. It is remarkable, here, that just as overall vegetative appearances of *Ruptiliocarpon* suggest Fabaceae, many of the wood characters, including vestured pits, are also in accordance with that family (Mennega, 1993). In any case, as shown elsewhere in this paper, floral and fruit characters of *Ruptiliocarpon* must eliminate Fabaceae from consideration and suggest Sapindales.

Other families of Sapindales such as Rutaceae and Simaroubaceae are similar to *Ruptiliocarpon* in many reproductive characters, but none coincides in convincing detail. In the Simaroubaceae stipules do occur (rarely) but arils are not known. Details of the flowers (free stamens, presence of a disk and usually only partially united carpels) tend to eliminate the family from consideration for *Ruptiliocarpon*. The capsular or follicular Rutaceae have fruits with similar loose, horny endocarps, but many other characters combine against placing caracolito in that family. In Rutaceae the exocarp remains with the infructescence rather than falling from the seed, the seeds lack arils, the flowers are bisexual, and stipules are wanting. Gland dots are present in the leaves of Rutaceae but lacking in *Ruptiliocarpon*. In Burseraceae (where stipules are rare but known) fruit dehiscence in certain genera (e.g., *Bursera*) is somewhat similar to caracolito in that the leathery exocarp falls away leaving the arillate diaspore attached to the pedicel, but the "aril" (pseudaril, fide Daly, 1989) is attached to the endocarp, which is stony and sealed until germination. In the genus *Dacryodes* the fruit is indehiscent with an oily and resinous mesocarp and an exarillate seed (Daley, pers comm.), but the cartilaginous endocarp is very similar to that of *Ruptiliocarpon*. The endocarp is separable into two pieces, one smaller and empty with the margin folded over, the other larger and covering the seed, just as in *Ruptiliocarpon*. Nevertheless, in contrast to *Ruptiliocarpon*, the tribe Canarieae, which includes *Dacryodes*, is characterized by 3-merous flowers, fused sepals, and valvate petals. Furthermore, in contrast to typical Burseraceae, caracolito lacks resin ducts in the bark, lacks a floral disk, has two (rather than four or five) carpels and has the stamens fused in a single whorl rather than free in two whorls. The Burseraceae were eliminated early on in the wood anatomy analysis because, in distinction to Meliaceae, Sapindaceae, and Rutaceae, the Burseraceae are rather uniform in their anatomy and not at all like *Ruptiliocarpon* (Mennega, 1993). The Sapindaceae are known to have stipules in some of the lianas and agree with caracolito in many floral details, although they always have free stamens and, typically, a nectary disk and an ovary with one or two ovules in each of three locules. In fruit, the only similarity between caracolito and Sapindaceae (other than the presence of an aril) is that in certain genera (e.g., *Paullinia* and *Thouinia*) the mature carpels often fall away (entire) from the central axis, and in caracolito the exocarp and endocarp split off (in pieces) leaving the seed dangling by the central axis.

But for a casual glance at the excellent revised edition of Thonner's key to families (Geesink et al., 1981), we might have published *Ruptiliocarpon* in its own new family, leaving *Lepidobotrys* stranded

TABLE 2. Differences between *Ruptiliocarpon* and *Lepidobotrys*.

	Ruptiliocarpon	*Lepidobotrys*
Vestured pits	+	−
Dioecy	cryptic	+ obvious
Fibrous exotegmen	+	−
Gynoecium	2-merous	3-merous
Styles	−	+
Exocarp	woody	leathery
Endocarp	cartilaginous	chartaceous
Filaments	short	long
Anthers	basifixed	versatile
Connective	apiculate	truncate
Inflorescences	panicle of spikes	fasciculate spikes

in Africa a while longer. The cryptic dioecy of *Ruptiliocarpon*, which was only revealed in 1992 by anatomical studies (Tobe & Hammel, 1993), is perhaps the one major clue that led to this late success with Thonner. *Lepidobotrys staudtii* Engler has unifoliolate leaves with fugaceous stipules and stipels, and an articulation at the upper pulvinus. It has leaf-opposed inflorescences; small green flowers with five imbricate sepals and petals; ten stamens of two different lengths with the filaments fused at the base into a nectary-tube; two collateral, apical ovules per locule; obturators; capsular fruits splitting septicidally to reveal a single, black, exendospermous seed with a red aril attached to the tip of the partition, which is in turn attached to the pedicel (Table 1 and Fig. 1).

Rank. Although cedro caracolito is very similar to *Lepidobotrys*, we distinguish *Ruptiliocarpon* because the two are different in ways that can be regarded as generic: *Ruptiliocarpon* has vestured pits, *Lepidobotrys* does not (Mennega, 1993); *Ruptiliocarpon* has nearly identical male and female inflorescences and flowers, in *Lepidobotrys* dioecy is more obvious; pedicels are lacking in *Ruptiliocarpon*, 5–8 mm long (male flowers) in *Lepidobotrys;* anthers are basifixed and apiculate in *Ruptiliocarpon*, versatile and truncate in *Lepidobotrys;* the fused part of the filaments (nectary-tube) is much longer than the free part in *Ruptiliocarpon*, much shorter in *Lepidobotrys; Ruptiliocarpon* has a sessile, bilobed stigma and 2-locular ovary, *Lepidobotrys* has 3 styles and 3-locular ovary; the exocarp is woody and irregularly dehiscent with a cartilagenous endocarp in *Ruptiliocarpon* but leathery and 3-parted and with a papery endocarp in *Lepidobotrys;* the persistent partition is much narrower than the seed in *Ruptiliocarpon*, nearly as wide as or wider than the seed in *Lepidobotrys;* the mature seed of *Ruptiliocarpon* has a fibrous exotegmen lacking in *Lepidobotrys* (Tobe & Hammel, 1993) (Table 2).

LEPIDOBOTRYACEAE RECONSIDERED

Although Léonard (1950) reviewed the literature concerning *Lepidobotrys* and described the family Lepidobotryaceae, the issue was not settled. Hutchinson (1959, 1967, 1973) included the primarily tropical Asian *Dapania* and *Sarcotheca* in Lepidobotryaceae. However, as pointed out by Veldkamp (1967) in his revision of these two genera and also by Willis (1973), *Dapania* and *Sarcotheca* are decidedly members of Oxalidaceae and closely related to *Averrhoa*, whereas their relationship to *Lepidobotrys* is questionable. Oltmann (1971) stated that the pollen of Lepidobotryaceae (including *Dapania* and *Sarcotheca*) stands next to Oxalidaceae but also shows affinity to the broadly circumscribed Linaceae complex where the floral morphology is more concordant, particularly with that of *Lepidobotrys* (e.g., presence of obturators). Huynh (1969) considered that the pollen of *Lepidobotrys* can be distinguished from all others of the family (Oxalidaceae) by its very long apertures. Oltmann (1971) also felt that *Lepidobotrys* has pollen distinct enough to support status as a separate family. Leaf anatomy (cf. discussion in Mennega, 1993) is uninformative on the question and wood anatomy, itself, does not presently resolve the issue.

The most striking similarities between *Lepidobotrys* and Oxalidaceae (i.e., *Dapania* and *Sarcotheca*) lie in the unifoliolate, articulate leaves and the woody habit. According to Léonard (1950), this similarity to leaves of Oxalidaceae, which generally have compound leaves with articulate leaflets, was Hallier's (1923) and later Knuth's (1931) principal reason for removing *Lepidobotrys* from Linaceae and placing it in Oxalidaceae. They might just as

well have placed it in the Fabaceae, where groups with not only compound leaves and articulated leaflets exist, but also with stipules and stipels, features lacking in Oxalidaceae including *Dapania* and *Sarcotheca*. The filaments of two lengths are also suggestive of Oxalidaceae, but that condition is present, as well, in some Sapindales, e.g., *Trichilia* spp. (Pennington, 1981).

The main new evidence presented here in support of Léonard's recognition of Lepidobotryaceae as a family distinct from Oxalidaceae has to do with obturators and endosperm. Engler (1902) described the ovules of *Lepidobotrys* as having the placenta dilated into a caruncle that covers the micropyle. As pointed out by Hallier (1923) and Oltmann (1971) this structure is an obturator, which presumably serves to guide pollen tubes to the micropyle (Cronquist, 1981). Placental obturators are also present in *Ruptiliocarpon* but lacking in Oxalidaceae. Both *Lepidobotrys* and *Ruptiliocarpon* lack endosperm in mature seeds (Tobe & Hammel, 1993). Although endosperm is often scanty or absent in some members of Cronquist's Geraniales (Geraniaceae and Balsaminaceae), it is nearly always copious in Oxalidaceae. Furthermore, Léonard did not point out that the petals are clawed in Oxalidaceae but unclawed in *Lepidobotrys* (and *Ruptiliocarpon*). Leaves and bark of *Ruptiliocarpon* have bitter substances while those of Oxalidaceae are sour or acidic. The Oxalidaceae are said to be tenuinucellate (Cronquist, 1981), whereas at least *Ruptiliocarpon* is crassinucellate. However, *Averrhoa* (Oxalidaceae) is also crassinucellate (Thathachar, 1942).

In addition to the above, and as pointed out by Léonard, Lepidobotryaceae differ importantly from Oxalidaceae in having septicidal (or irregular) rather than loculicidal (or no) dehiscence, collateral rather than superposed ovules, two or three carpels rather than five, and a disk (nectar-producing fused portion of filaments) (Table 3). With regard to the disk, a similarity to Oxalidaceae should be examined further; Cronquist stated that the outer filaments are often thickened nectariferous below in Oxalidaceae. Also the nature of the so-called disk in *Lepidobotrys* needs to be studied histologically. In contrast to published descriptions and drawings (e.g., Knuth, 1931; Tisserant, 1949; Léonard, 1950; Hutchinson, 1959; Badré, 1973), our examination of reconstituted dried male flowers of *L. staudtii* revealed no discontinuity (other than fusion) between free parts of filaments and the point where the androecial structure attaches to the base of the petals. The filaments simply expand gradually from tip to base and the "disk" seems quite obviously to be the fused basal portion of the filaments. We had this same problem with *Ruptiliocarpon*, interpreting the structure first as a disk, then as a filament tube until finally it was shown, histologically, to be both, staminal tube and nectary (Tobe & Hammel, 1993).

All evidence considered, placing *Lepidobotrys* in Oxalidaceae seems no more defensible than placing *Ruptiliocarpon* in Fabaceae. The leaves, outwardly so similar to *Dapania* and *Sarcotheca* in the former and *Swartzia* and *Bocoa* in the latter, have been the principal culprit in both these errors and are homologous, we believe, only in the case of uniting *Ruptiliocarpon* with *Lepidobotrys*. Where, then, do the broader affinities of Lepidobotryaceae lie?

Léonard (1950) also compared *Lepidobotrys* with Linaceae and Erythroxylaceae, but none of the new evidence we have accumulated for *Ruptiliocarpon* suggests a particularly close relationship to either of those two families (Mennega, pers. comm.; Tobe, pers. comm.). Our preliminary studies of *Ruptiliocarpon* focused almost entirely on comparison with families of Sapindales, and that comparison, although discarded for *Lepidobotrys* by Léonard (1950), is still viable on the basis of floral, seed coat, and wood anatomy. *Ruptiliocarpon* seemed particularly close to Meliaceae, but its pollen, while similar to that of Sapindaceae (Hooghiemstra, pers. comm.; Pennington, pers. comm.), is not consistent with placement in the Meliaceae as it lacks the thickenings at the apertures, characteristic of that family (Hooghiemstra, pers. comm.).

Lepidobotryaceae, apparently, has never been compared to the Euphorbiaceae. However, its dioecy and obturators (both revealed very late in the investigation of *Ruptiliocarpon*) give credence to that possibility. The paired, apical, collateral ovules coincide directly with the primitive subfamily of euphorbs, Phyllanthoideae (Webster, 1975). Fibrous exotegmen, a character emphasized by Tobe & Hammel in comparing *Ruptiliocarpon* to Meliaceae, is also found among the Phyllanthoideae (Corner, 1976). Other important characters consistent with Euphorbiaceae include: two or three carpels; septicidal dehiscence; differentiation and separation of exocarp and endocarp; shape of the endocarp; and attachment of the seed via the aril (as in e.g., *Aporosa* and *Richeria*) to the persistent axis, which is suggestive of the characteristic euphorb columella (Cronquist, 1981). Although all of the wood anatomical characters manifested by Lepidobotryaceae may be found among the Phyllanthoideae, its particular set of characters is not found in any one genus (Mennega, pers. comm.) Furthermore, the androecium of Lepidobotryaceae, with its filament-tube disk, and the unifoliolate, articulate leaves are discordant in Euphorbiaceae. If Lepidobotyraceae

TABLE 3. Comparison of Lepidobotryaceae to Meliaceae, Oxalidaceae, and Euphorbiaceae.

	Lepidobotryaceae	Meliaceae	Oxalidaceae	Euphorbiaceae
Leaves	unifoliolate	compound, rarely unifoliolate	compound, rarely unifoliolate	simple, rarely compound or unifoliolate (?)
Petiole	articulate with the petiolule	continuous	articulate with petiolule in unifoliate spp.	continuous
Stipules	+	−	−	+
Wood (vestured pits)	±	−	−	− (+ in one genus)
Inflorescence	leaf-opposed	axillary, terminal or rarely extra-axillary	axillary	axillary, terminal or very rarely leaf-opposed
Flowers	unisexual	uni-bisexual	bisexual	unisexual
Stamens	10	10 (−25)	10	(1−)5−many
Filaments	fused, bicyclic	fused, sometimes bicyclic	fused, bicyclic	free-fused, not bicyclic
Nectary	staminal tube	separate or lacking	? (as scales) or lacking	separate or lacking
Carpels	2 or 3	(1−)2−5(−20)	5	2 or 3(−4−many)
Ovules/locule	2 collateral	(1−)2(−12) collateral or superposed	(1−)2−several superposed	1 or 2 collateral
Obturator	+	±	−	+
Placentation	apical-axial	axial (often apical)	axial	apical-axial
Fruit	septicidal capsule	septi-loculicidal capsule	loculicidal capsule	septicidal (schizocarp)-various
Seed	1	1−many	numerous	(1−)3−several
Seed coat (fibrous exotegmen)	±	±	−	±
Endosperm	−	+ (−)	+	+ (−)

were found to be a close outgroup to Euphorbiaceae, the generally accepted, simple-leaved origin of the Euphorbiaceae might be challenged. We have found a family for *Ruptiliocarpon* but the exact placement of Lepidobotryaceae among other Rosidae is not yet clear.

BIOGEOGRAPHY

Apparent sister genera separated by the Atlantic, *Ruptiliocarpon* and *Lepidobotrys* keep company with such taxa as *Cecropia–Musanga* and *Pourouma–Myrianthus* (Cecropiaceae—Berg, 1978), *Duguetia–Pachypodanthium* (Annonaceae—Schatz, pers. comm.) and numerous others cited by Thorne (1973). These pairs, endemic to their respective continents, are examples suggesting that vicariance of the original population via plate tectonics resulted in the taxonomic structure we see. The substantial differentiation between *Ruptiliocarpon* and *Lepidobotrys*, as well as the wide distribution of *Ruptiliocarpon* within the Neotropics, is consistent with a division in the range of the ancestor population somewhere near or relatively

soon after the South American and African plates began to separate about, 100 million years ago (Raven & Axelrod, 1974). In contrast to the recently described *Nyssa* (Cornaceae) and *Ticodendron* (Ticodendraceae) from Costa Rica (cf. Hammel & Burger, 1991; Hammel & Zamora, 1990) we have no evidence here to support a boreotropical origin of *Ruptiliocarpon* (cf. Lavin & Luckow, 1993). Rather, the wide distribution and variability of *Ruptiliocarpon* in South America and its restriction to Costa Rica otherwise, suggest dispersal into Central America from a South American origin. Within this context, Lepidobotryaceae may be quite old, as is also suggested by its similarity to primitive members of various more or less disparate groups in the Rosidae.

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Note added in proof. We have now found flowering material from South America from among the family indets. at the Field Museum of Natural History: PERU. Loreto: Mishuyacu, near Iquitos, 100 m, Jan. 1930 (fl), *Klug 749* (F). Annotations indicate that Erythroxylaceae, Meliaceae, and Burseraceae had been successively considered. The flowers are somewhat larger than those of the Costa Rican material.

Comparative Wood Anatomy of *Ruptiliocarpon caracolito* (Lepidobotryaceae)

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ABSTRACT. Wood anatomy of *Ruptiliocarpon caracolito* is described and compared in general to Sapindales, and specifically to *Trichilia* (Meliaceae) and the monotypic, African *Lepidobotrys* (Lepidobotryaceae). It is aberrant in all groups compared for having vestured pits. Otherwise, it is most similar to both *Trichilia* and *Lepidobotrys*. Wood anatomy does not conflict with the recognition of *Ruptiliocarpon* as a second genus of Lepidobotryaceae; however, the question of affinities of that family needs further investigation.

Analysis of wood anatomy is often crucial for the elucidation of relationships of taxa problematic at the generic or higher levels (cf. Hayden & Brandt, 1984; Mennega, 1984; Pennington & Styles, 1975). During the course of an investigation (Hammel & Zamora, 1993) into the affinities of a Costa Rican tree that could not be placed to family, an analysis of its wood anatomy became essential.

MATERIALS AND METHODS

Microtome sections and macerations of wood of *Ruptiliocarpon caracolito* Hammel & N. Zamora from the trunk (*Hammel & Chavarría 17965*, bole ca. 17 cm diam.; MO) and from a branch (*Hammel 17983*, 4.5 cm diam.; MO) both from near Rincón de Osa on the Osa Peninsula of Costa Rica, of *Lepidobotrys staudtii* Engler (*Breteler 2087*, Cameroon near village Zendé, tree 15 m; Uw, WAGw), and of *Trichilia lepidota* C. Martius subsp. *leucastera* (Sandwith) Pennington (*Maas 10841*, Suriname, Maratakka, tree 13 cm diam.; Uw) were prepared according to standard methods (Mennega, 1982). Descriptions, counts, and measurements follow recommendations of the International Association of Wood Anatomists Committee (IAWA, 1989).

WOOD ANATOMY OF *RUPTILIOCARPON CARACOLITO*

GENERAL ASPECT

A straight-grained wood apparently without differentiation in sapwood and heartwood, color uniformly light, pinkish cream; moderately light, volume weight ca. 0.40.

MICROSCOPIC CHARACTERS (FIG. 1)

Growth rings faint, formed by a narrow zone of flattened fibers and occasionally by a 1- or 2-celled band of parenchyma. *Vessels* solitary for about 45%, the remainder in radial multiples of 2 or 3(–8) and a few clusters, the latter mainly on the border of the growth ring; number 5(0–12) per sq. mm, distribution somewhat irregular; perforations simple, perforation plates oblique; cross section oval to round, diameter (70–)100–140 μm, average vessel member length 860(600–1,300) μm, mostly with long, narrow tails; intervascular pits alternate, crowded, vestured, diameter 5–6.5 μm, the slits enclosed or locally confluent; vessel/ray pitting similar; resinous contents occasionally present. *Fibers* regularly distributed, angular in cross section, thin-walled, diameter 22–28 μm, the walls 2.5–3.5 μm wide; nonseptate; minute bordered pits restricted to the radial walls; length 1,000(750–1,290) μm. Fiber/vessel ratio 1.16. *Rays* uniseriate, homogeneous or nearly so, cells procumbent, except for a marginal row of slightly higher and shorter cells, which resemble square cells; number 5–7 per mm; width 15 μm, height 130–500 μm, up to 21 cells high; no contents. *Parenchyma* as scattered strands and in fine, often interrupted, rather straight bands 1 or 2 cells wide, also paratracheal, narrow vasicentric, occasionally aliform; terminal parenchyma as a band 1 or 2(–4) cells wide. Number of bands 6–8 per mm; strands of (2–)4–8 cells. Rhombic crystals numerous in subdivided cells of the isolated strands.

DISCUSSION

Preliminary analysis of wood samples of *Ruptiliocarpon* suggested a relationship to Meliaceae by way of a very close match to the genus *Trichilia*. This was in agreement with Hammel and Zamora's independent conclusion that *Ruptiliocarpon* seemed to belong to Sapindales. Although they found that

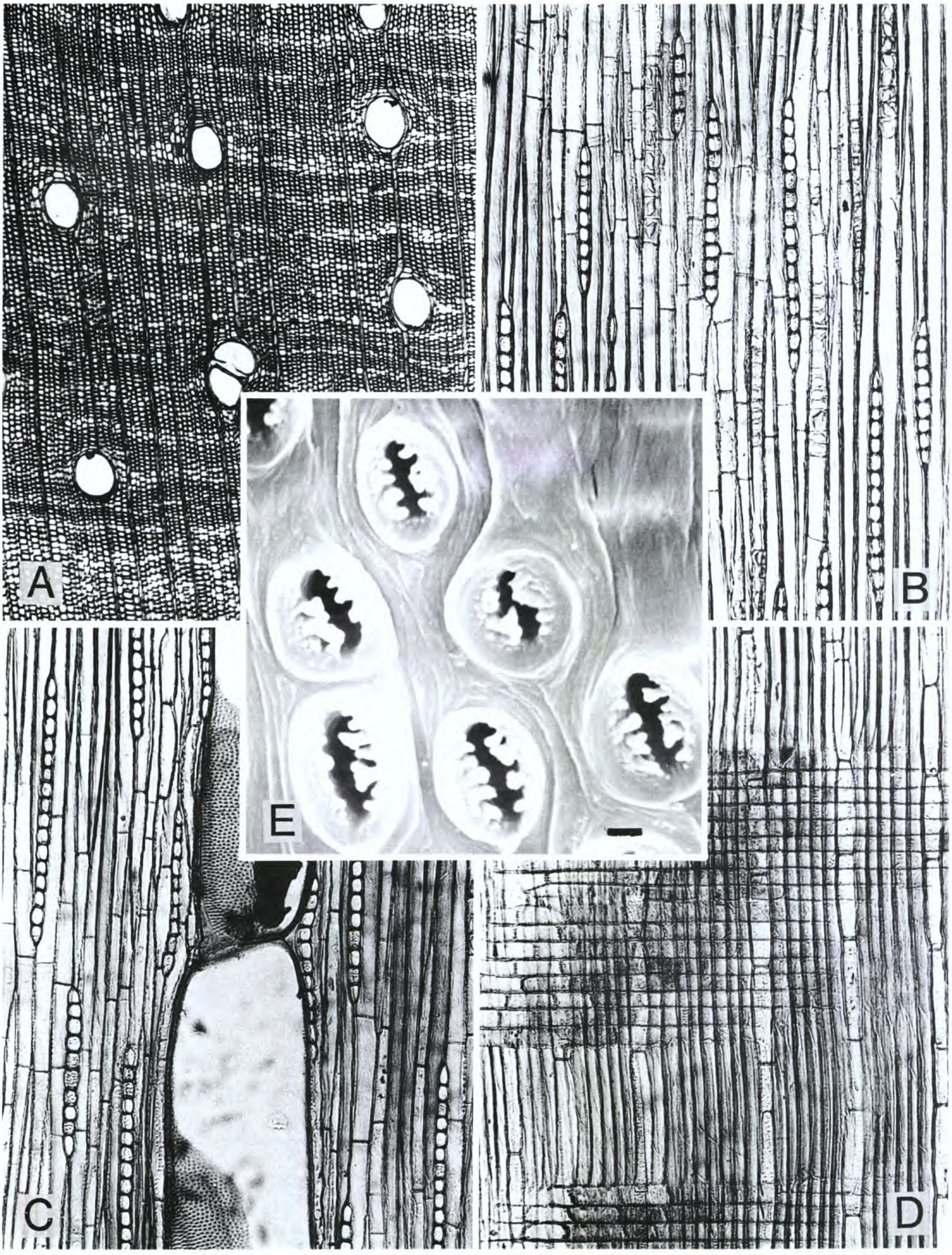
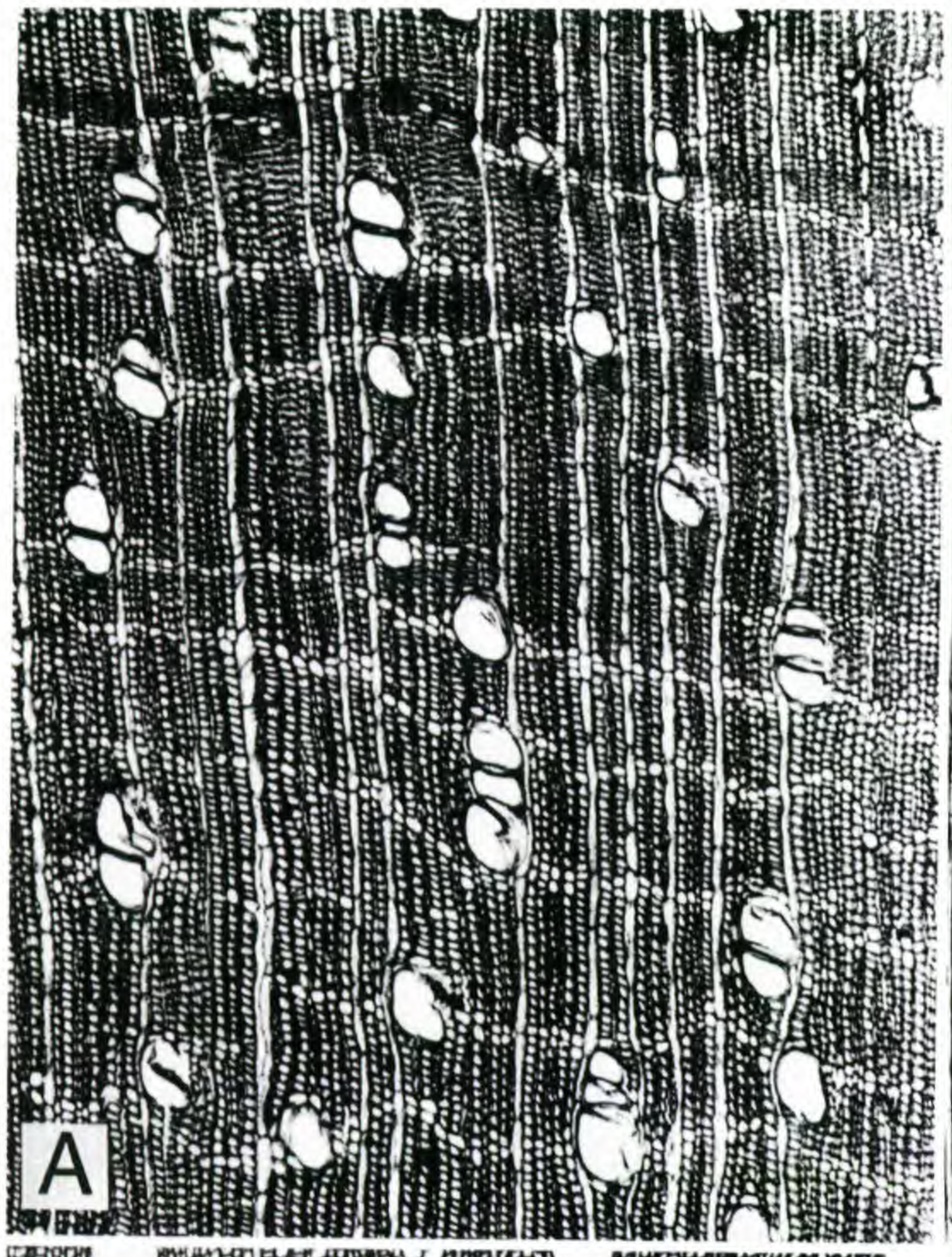
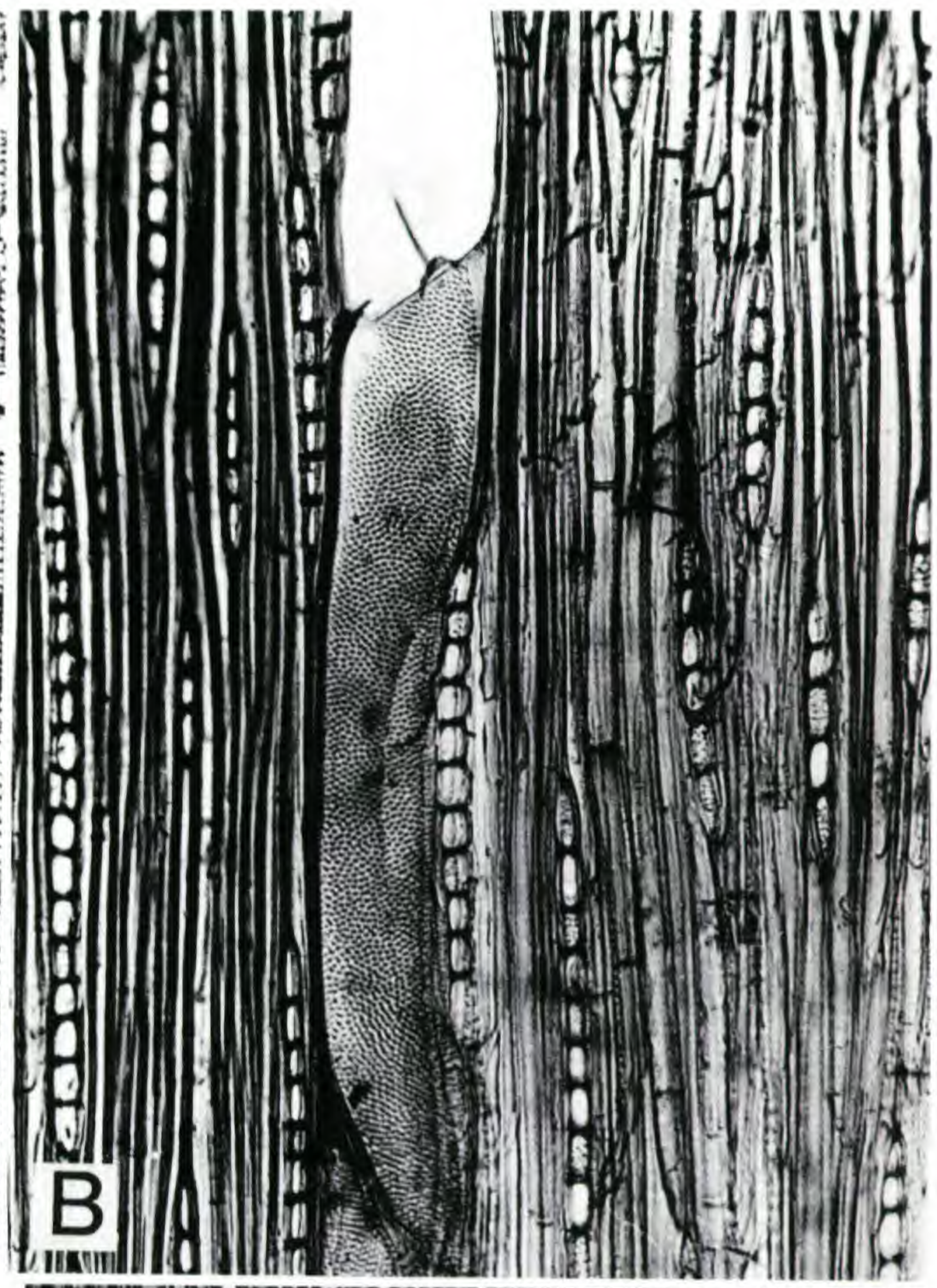
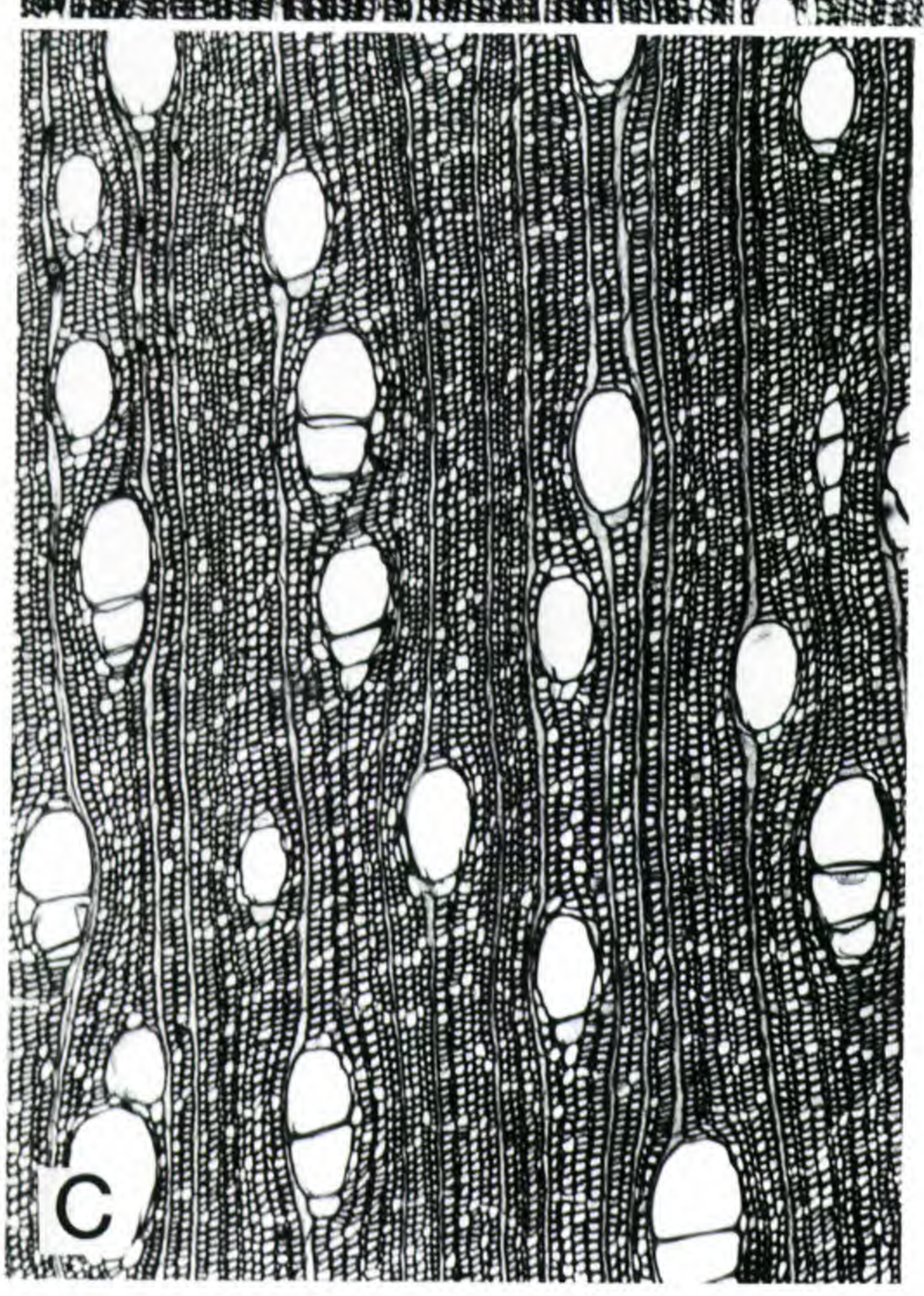


Figure 1. *Ruptiliocarpon caracolito* Hammel & N. Zamora. —A. Transverse section, ×45. Vessel and parenchyma distribution. —B. Tangential longitudinal section, ×112. Uniseriate rays and parenchyma strands, partly with crystals. —C. Tangential longitudinal section, ×112. A vessel member with a lump of gum. —D. Radial longitudinal section, ×112. Homogeneous to weakly heterogeneous rays. All from *Hammel & Chavarría 17965*. —E. Vestured intervascular pitting; *Hammel 17983*.







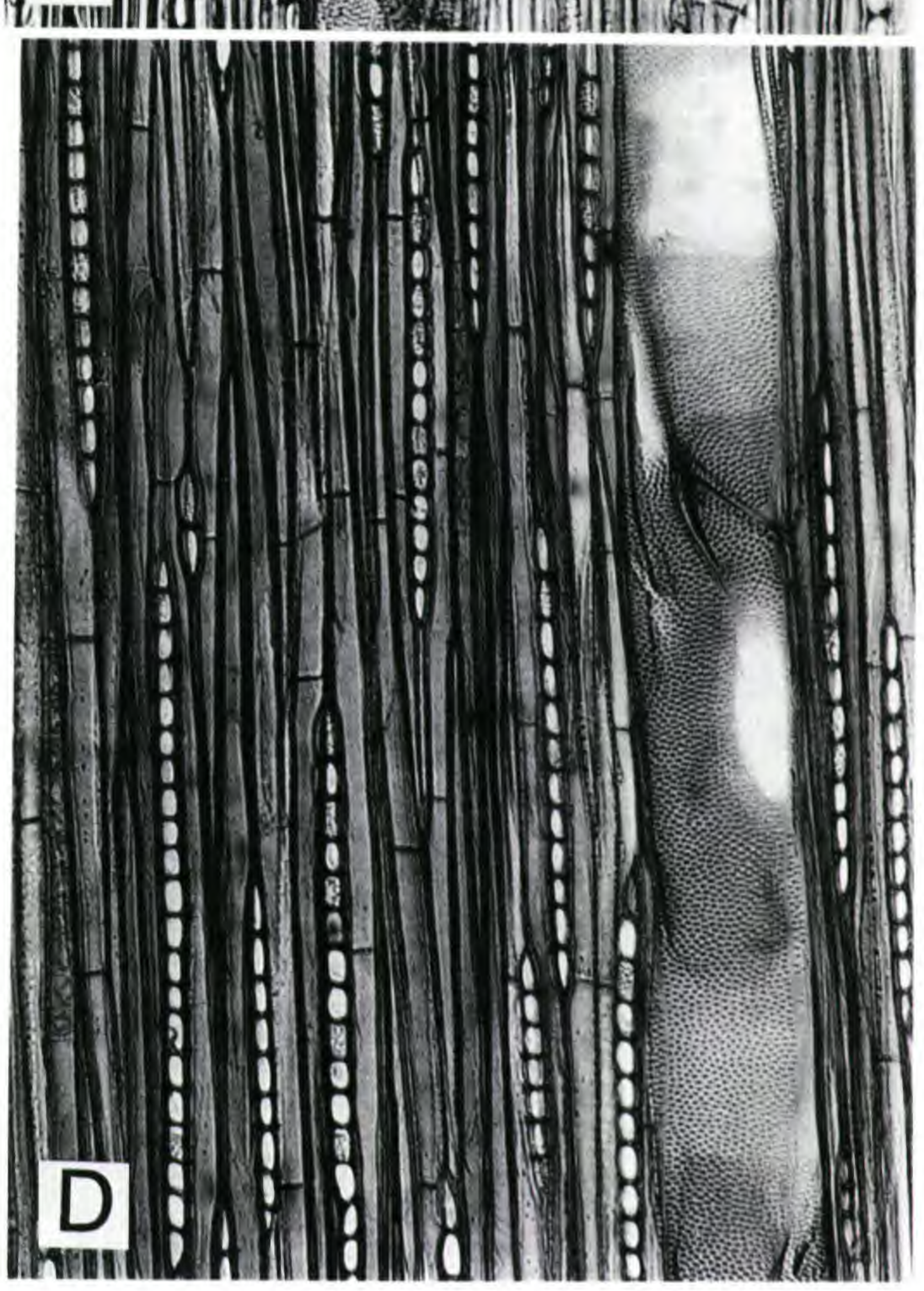


Figure 2. A, B. *Trichilia lepidota* C. Martius subsp. *leucastera* (Sandwith) Pennington. —A. Transverse section, ×45. Vessel and parenchyma distribution. —B. Tangential longitudinal section, ×112. Intervascular pitting and uniseriate rays. Both from *Maas 10841*. C, D. *Lepidobotrys staudtii* Engler. —C. Transverse section, ×47. Vessel and parenchyma distribution. —D. Tangential longitudinal section, × 120. Uniseriate rays, intervascular pitting, crystal-bearing parenchyma strand (left side). Both from *Breteler 2087*.

certain features of the fruits of Burseraceae resemble those of *Ruptiliocarpon*, vessels with large pits, septate fibers, and scarce parenchyma are salient features of Burseraceae that characterize their difference from *Ruptiliocarpon* and eliminate that family from consideration as a close relative. Three Sapindalean families, Sapindaceae, Hippocastanaceae, and Meliaceae, have members with wood that superficially resembles that of *Ruptiliocarpon*. In Sapindaceae, which like Meliaceae has great diversity in wood structure, the genus *Talisia* shows a remarkable similarity to *Trichilia* (Mennega, 1972) and therefore with *Ruptiliocarpon* (see below). The main difference is the occurrence of septate fibers in *Talisia*, in particular in the species with thin-walled fibers. *Billia* (Hippocastanaceae) is comparable to *Ruptiliocarpon* but here more numerous dissimilarities occur; these include a different parenchyma distribution with mainly rather wide conspicuous terminal bands and hardly any diffuse strands, random occurrence of septate fibers, and shorter vessel members.

Among Sapindales, the closest match to *Ruptiliocarpon* is *Trichilia* of the Meliaceae. Superficial examination of the branch sample suggested a similarity to *Trichilia* (Fig. 2A, B), and that impression was confirmed in detail on closer study of cross sections. Wood characteristics of *Ruptiliocarpon* such as nonseptate fibers, small intervascular pits, uniseriate wood rays that are weakly heterogeneous and not over 20 cells high, parenchyma in narrow wavy bands and partly aliform-confluent, several strands with rhombic crystals, and normal strands of 4–8 cells are features present in *Trichilia* according to older and more recent literature (e.g., Pennington & Styles, 1975). In a study of wood samples from the Guianas, Klaassen (1988) confirmed the above features for nine species of *Trichilia* and also recorded a vessel member length of 550–760 μm, fiber length of 870–1,300 μm, very similar to those for *Ruptiliocarpon*.

One important feature, vesturement of the vessel pits, that was discovered later in this analysis and reconfirmed with SEM (Fig. 1E) does not coincide with *Trichilia* or with any other Meliaceae (Kribs, 1930; Record & Hess, 1943; Metcalfe & Chalk, 1950). A reference in Metcalfe & Chalk (1983) to a report of vestured pits in Meliaceae is an error; the original paper (Kanazawa, 1968) does not make that claim. It is remarkable, here, that just as overall vegetative appearances of *Ruptiliocarpon* suggest Leguminosae (see discussion in Hammel & Zamora, 1993), many of the wood characters, including vestured pits, are also in accordance with that family. In fact, in Record's (1944) key one is led to a choice between *Trichilia* with vascular pits less than 4 μm wide and Leguminosae with pits more than 4 μm; *Ruptiliocarpon*, with pits 5–6.5 μm in diameter, should key to Leguminosae. On the other hand, vessel members in legumes are seldom over 500 μm (Baretta-Kuipers, 1981; Metcalfe & Chalk, 1950; Reinders-Gouwentak & Rijsdijk, 1968), whereas in *Ruptiliocarpon* the length ranges from 600 to 1,300 μm. In any case, floral and fruit characters of *Ruptiliocarpon* must eliminate Leguminosae from consideration (Hammel & Zamora, 1993; Tobe & Hammel, 1993).

Ruptiliocarpon differs from *Trichilia* on the basis of wood anatomy primarily because of the vesturing of the vascular pits, a feature not reported for Meliaceae (nor any other Sapindales). Presence or absence of this feature has long been considered constant for a given family or genus. The few exceptions include the tribe Bauhinieae in Leguminosae, which lacks vestured pits, otherwise present in the family; *Bridelia*, the only Euphorbiaceae with vestured pits (Mennega, 1987); and certain species of *Prunus* from China (Zhang & Baas, 1992), a genus that otherwise lacks vestured pits. It may be that the exceptions are too many and that we should no longer attribute such great value to this feature as a condition *sine qua non* in assigning a given taxon to a family or genus, but it does add, importantly, to the list of characters suggesting that *Ruptiliocarpon* does not belong in *Trichilia* or even in Meliaceae.

On the eve of describing *Ruptiliocarpon* as a monotypic genus in its own family within Sapindales, congruence in a majority of vegetative, floral, and fruit characters with *Lepidobotrys*, an African monotypic genus in its own family, was discovered (Hammel & Zamora, 1993; Hammel, pers. comm.). Examination of wood of *Lepidobotrys staudtii* Engler (Fig. 2C, D) also revealed a close conformity to the wood of *Ruptiliocarpon*. Apart from the absence of vestured pits in *Lepidobotrys*, the main difference is found in the more diffuse parenchyma in the latter species. In wood anatomy *Trichilia* and *Lepidobotrys* appear to differ and agree with *Ruptiliocarpon* in similar ways, but the preponderance of other evidence favors a relationship with *Lepidobotrys* (Hammel & Zamora, 1993). The question of where the affinities of Lepidobotryaceae (*Lepidobotrys* and *Ruptiliocarpon*) lie remains open. The historical alignment of Lepidobotryaceae in the Linaceae complex or in Oxalidaceae was discussed by Van Welzen & Baas (1984) based on a leaf anatomical study. Since leaf anatomy proved neutral

with respect to the question, they saw no reason to differ from the generally accepted preference for its placement in Oxalidaceae. However, the wood structure of *Lepidobotrys*, poorly known at the time Van Welzen & Baas published their analysis (cf. Metcalfe & Chalk, 1950: 272), is in several respects entirely different from that of *Averrhoa*, one of the few woody members of Oxalidaceae. The Linaceae complex comprises several mainly woody families with a rather great diversity of structure. From literature and personal knowledge of the wood structure of genera belonging to these families, a close relationship of Lepidobotryaceae with that complex seems improbable. For a well-founded statement, comparative research of a much broader scope than this paper would be necessary. The present study, along with accumulated knowledge (cf. Mennega, 1987), suggests that a relationship to the Sapindales or to Euphorbiaceae, as proposed by Hammel & Zamora (1993), should also be considered. Wood anatomy alone does not support or eliminate the possibility that Lepidobotryaceae may lie close to Euphorbiaceae. Although most of the wood anatomical characters present in Lepidobotryaceae are manifested among the genera of Euphorbiaceae in subfamily Phyllanthoideae, they are not found together in any one genus. Also, rays in Phyllanthoideae woods are decidedly heterogeneous, whereas those of Lepidobotryaceae are homogeneous or nearly so.

Acknowledgments. It was a great pleasure to have the opportunity to discuss the problematic wood of *Ruptiliocarpon* with Regis B. Miller during his recent brief visit to Utrecht. I am also greatly indebted to him for the kind offer to have the SEM photographs made in Madison at the U.S. Forestry Products Laboratory. I thank my colleagues J. Koek-Noorman, L. Y. Th. Westra and B. J. H. ter Welle for critical remarks and for technical advice and assistance. Thanks are also due to B. Hammel for his much appreciated suggestions for textual improvements. To D. Makhan I am indebted for the preparation of slides.

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Floral Morphology, Embryology, and Seed Anatomy of *Ruptiliocarpon caracolito* (Lepidobotryaceae)

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ABSTRACT. Floral and seed anatomy of *Ruptiliocarpon caracolito*, based on histological studies, are described in detail. Cryptic dioecy, a nectariferous staminal tube, and ovules with obturators comprise the characters most crucial to elucidation of relationships of this taxon. Originally compared among Sapindales, *Ruptiliocarpon* seemed close to but distinct from Meliaceae; floral anatomy suggested that it be recognized in its own separate family, a move obviated by the discovery of its close relationship to the monotypic African Lepidobotryaceae. However, the floral and seed anatomy of *Lepidobotrys* have not been studied in the same detail as those of *Ruptiliocarpon*, and the relationships of Lepidobotryaceae (*Ruptiliocarpon* and *Lepidobotrys*) remain controversial. A preliminary survey of the literature supports the suggestion that Lepidobotryaceae may be closer to Sapindales or perhaps Euphorbiaceae than to other groups with which it has been compared.

Histological studies of floral and seed anatomy often provide critical information for discovering relationships of problematic taxa (cf. Tobe, 1991; Hammel & Wilder, 1989). Material from collections of yet another Costa Rican tree that could not be placed to family was analyzed to that end.

MATERIALS AND METHODS

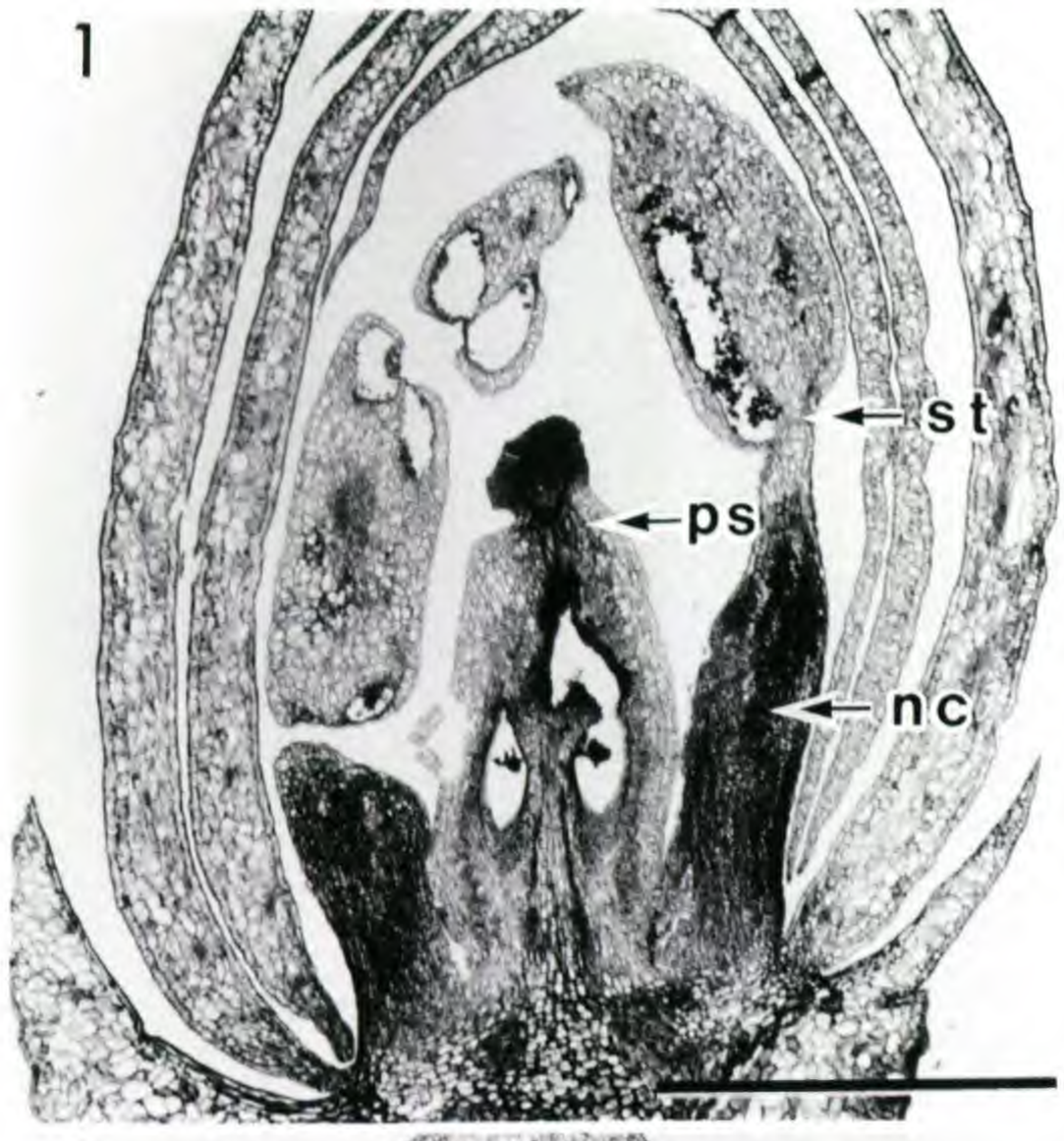
Buds (*Aguilar & Hammel 101*, *Aguilar et al. 103*, *Hammel et al. 18154*, *18166*), young fruits and mature seeds (*Aguilar et al. 103*, *Hammel 17983*) were fixed in FAA for this analysis. Buds and young fruits were softened as described in Tobe & Raven (1984) and thin sectioned with a rotary microtome following standard paraffin methods. Sections were stained with Heidenhain's hematoxylin, safranin, and fastgreen FCF. Pieces of mature seed coat were dehydrated through an ethanol series, embedded with Technovit 7100 (Kulzer & Co., Germany) resin, sectioned on a rotary microtome and stained with 0.02% Toluidineblue O (Tobe et al., 1992).

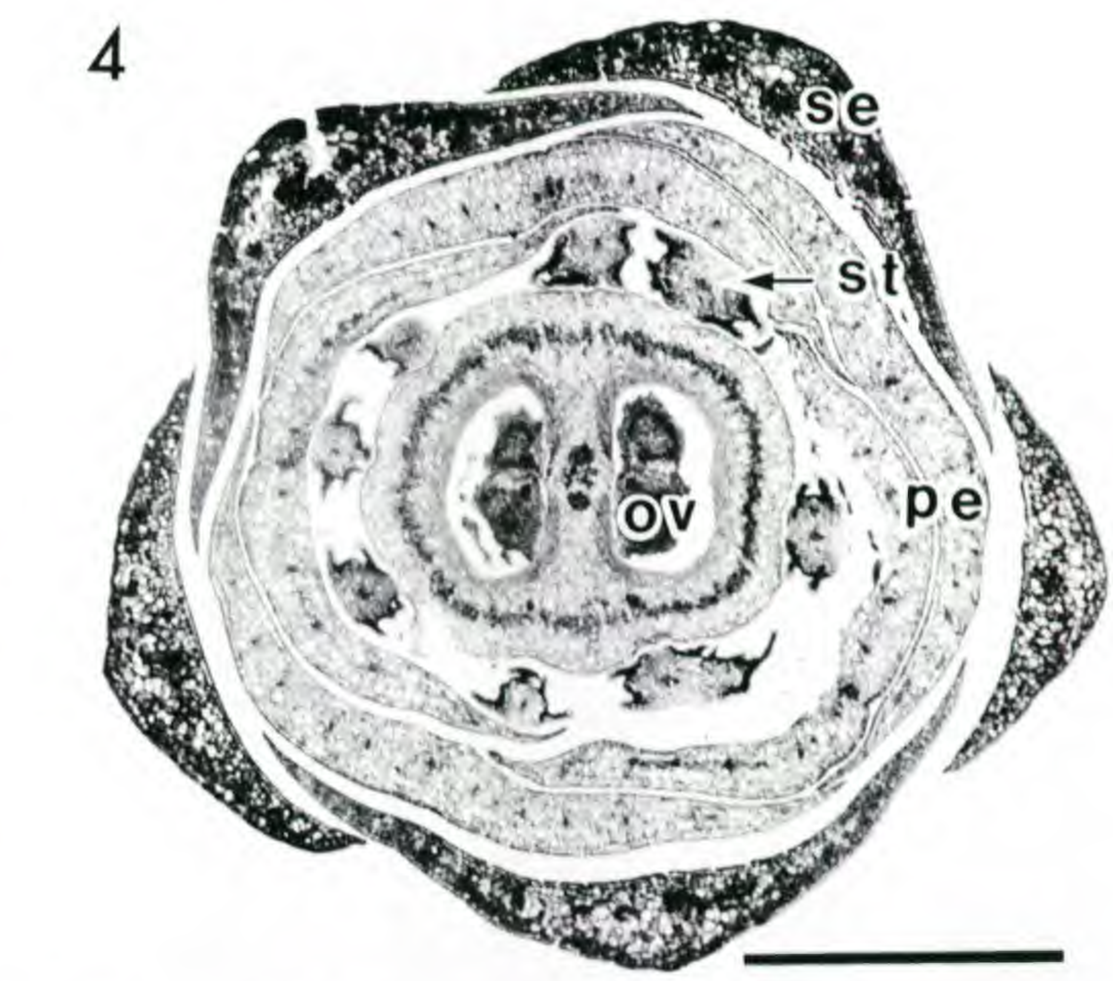
FLORAL MORPHOLOGY

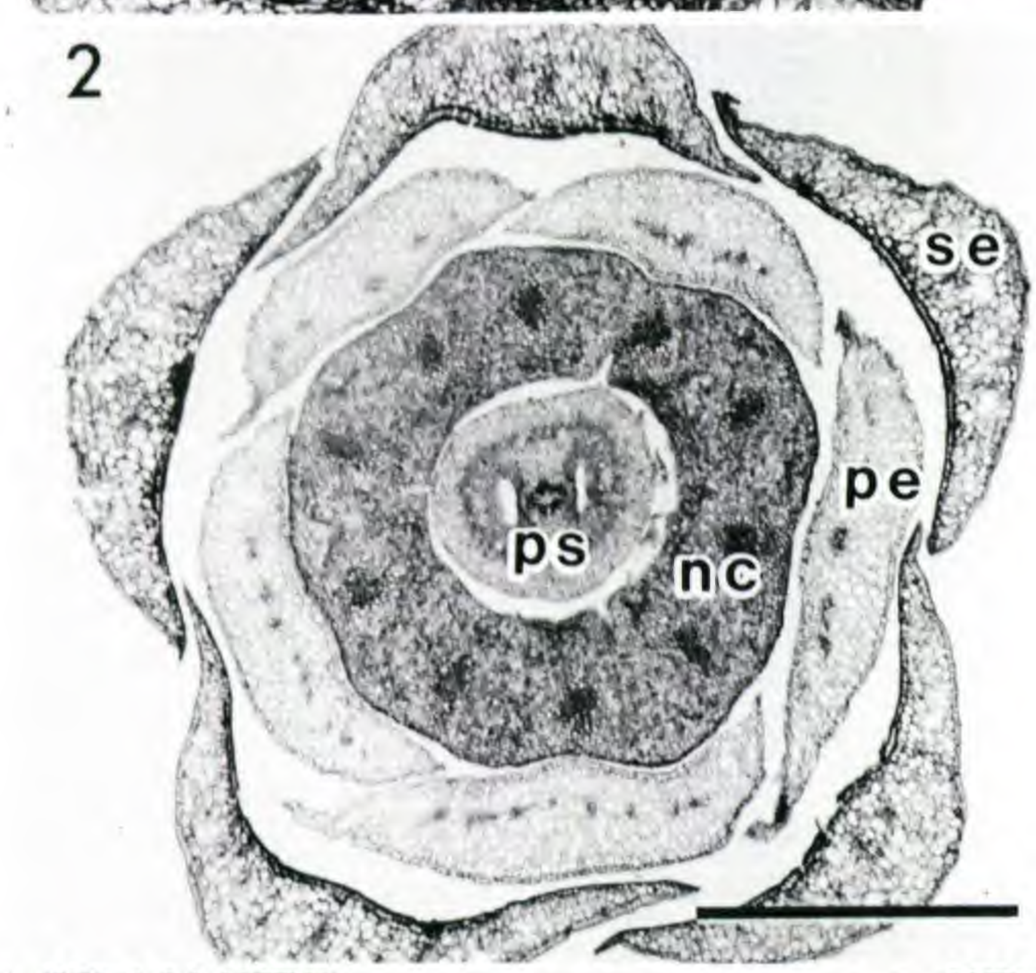
As indicated by anatomical sections, flowers are unisexual and the plants apparently dioecious. All flowers have stamens and a pistil, but the pistil of male flowers (*Aguilar & Hammel 101*, *Hammel et al. 18154*, *18166*) is smaller than that of female flowers (*Aguilar et al. 103*) and bears only rudimentary ovules (Figs. 1, 2). Female flowers have stamens with shorter filaments and lack pollen grains in anthers (Figs. 4, 5).

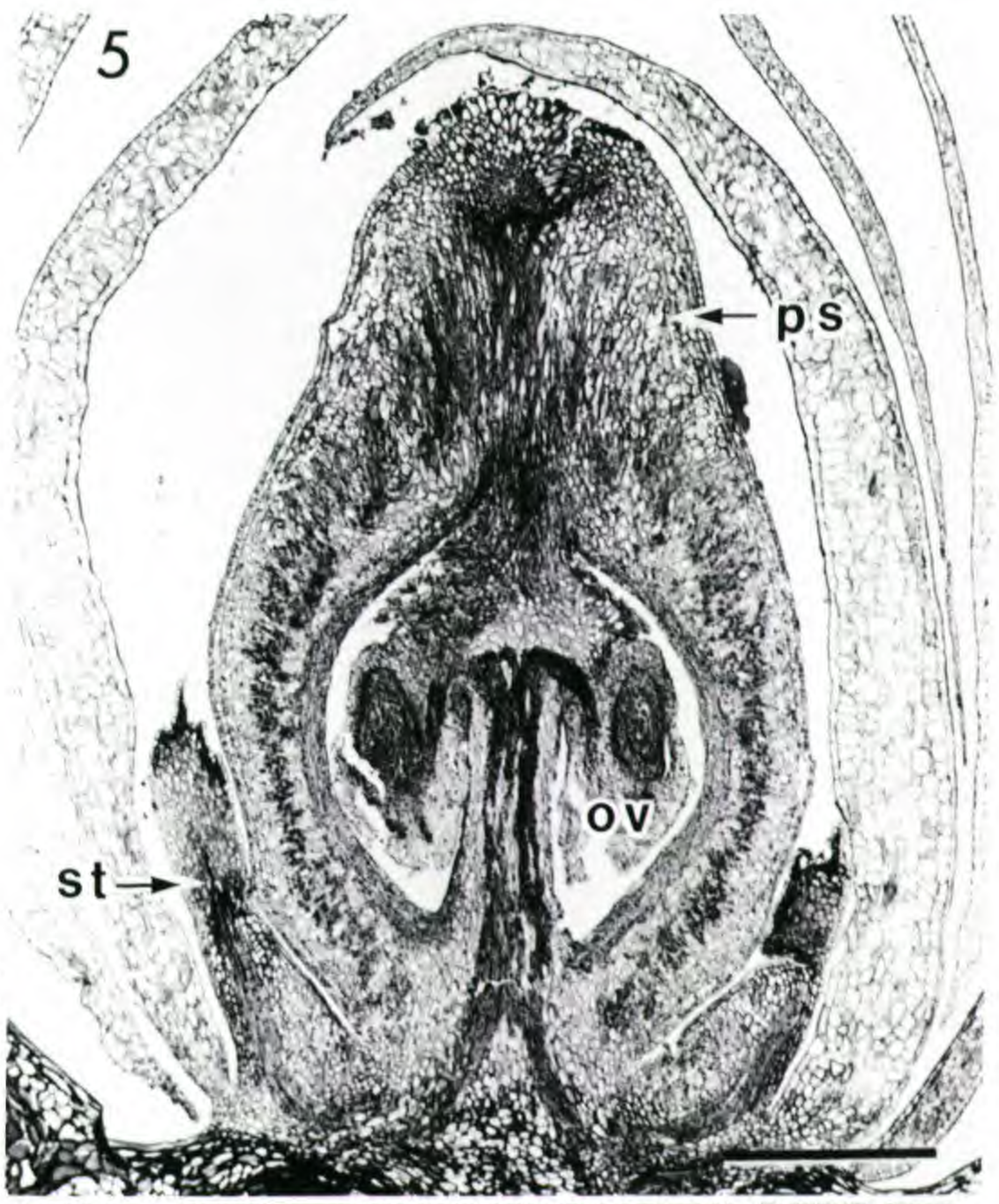
Flowers are pentamerous, comprising five sepals, five petals, ten stamens, and one pistil (Figs. 2, 4, 7). Both sepals and petals are free and imbricate in aestivation and alternately arranged. The ten stamens are inserted at the same level of the receptacle and fused along nearly the entire length of their filaments, forming a staminal tube (Fig. 2). The staminal tube is particularly conspicuous in the male flowers, where filaments are longer. There, the five antisepal stamens have a short length of free filament extending beyond the staminal tube, while the five antipetal stamens lack free filament (Fig. 7A, H, J). In the male flowers the nectariferous staminal tube is densely stained and even has vascular tissue that is profusely branched on the adaxial side (Fig. 3). The staminal tube is massive and histologically appears to represent a nectary. Neither an intrastaminal nor a gynophoreal nectary is present. In female flowers, however, the staminal tube is less conspicuous (Fig. 6) and may not actually exude nectar.

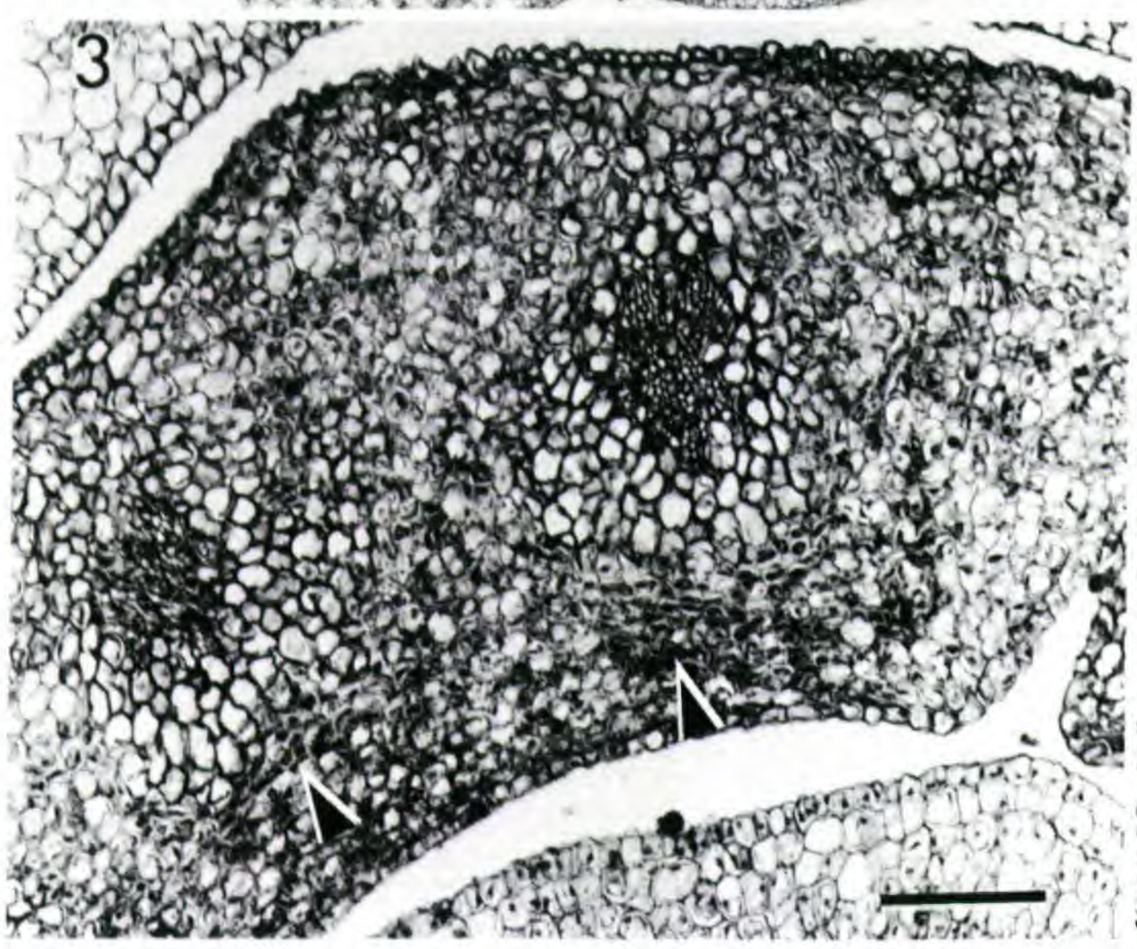
Vascular tissue just below the level of the receptacle in male flowers forms a vascular cylinder of ca. 10 discrete vascular bundles (Fig. 7B). At and above the level of the calyx, the vascular bundles divide and successively supply vascular tissue to sepals, petals, stamens, and pistil (Fig. 7C–F). Each











Figures 1–6. Floral anatomy of *Ruptiliocarpon*. —1. Longitudinal section of male flower. —2. Transverse section of male flower. —3. Transverse section of nectariferous staminal tube of male flower. Arrowheads indicate vascular tissue of the nectary. —4. Transverse section of female flower. —5. Longitudinal section of female flower. —6. Longitudinal section of stamen base of female flower. Arrowhead points to adaxial side of filament. Abbreviations: nc, nectary (nectariferous staminal tube); ov, ovule; pe, petal; ps, pistil; se, sepal; st, stamen. Scales equal 10 μm in Figures 3 and 6, 1 mm in Figures 1, 2, 4, 5.

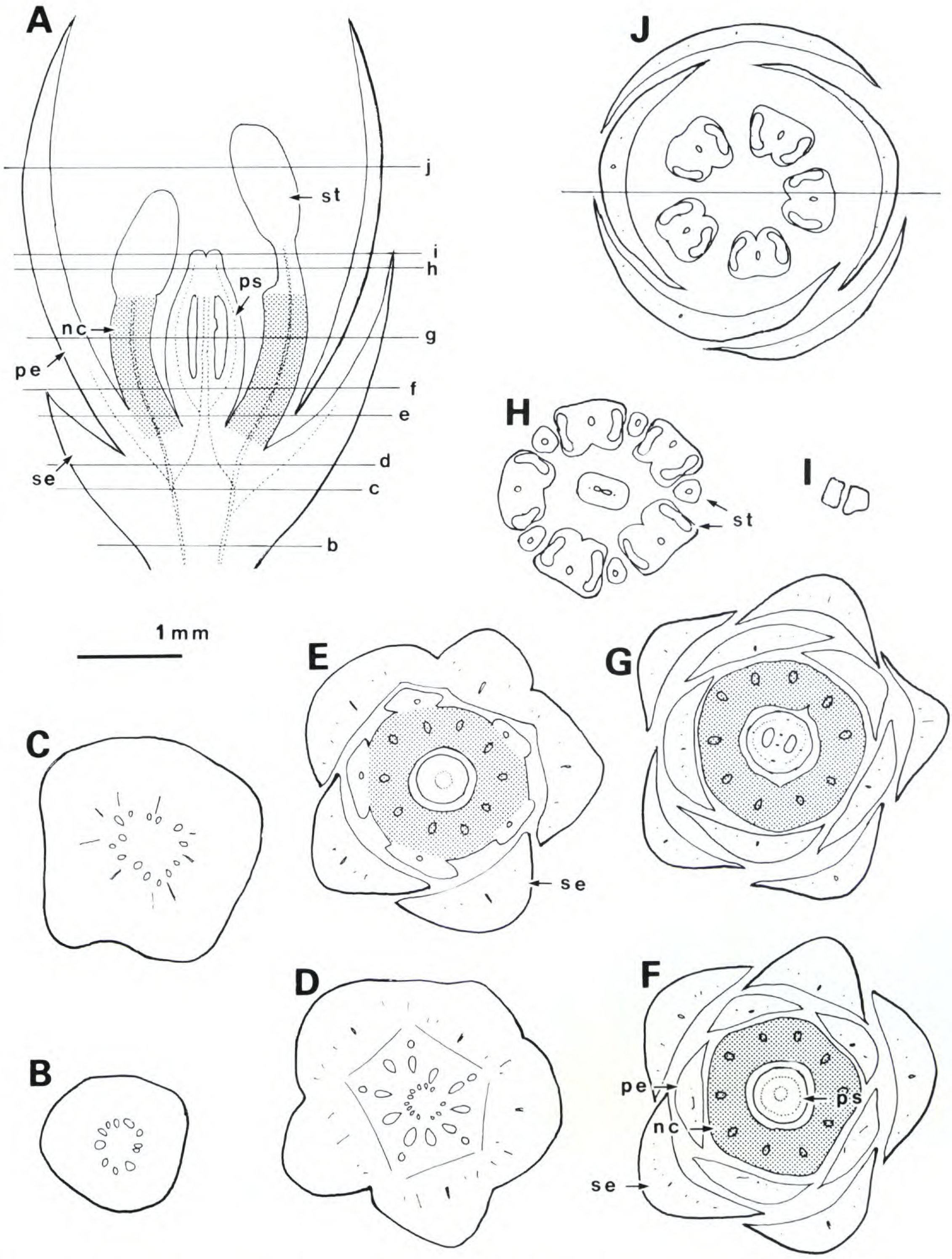
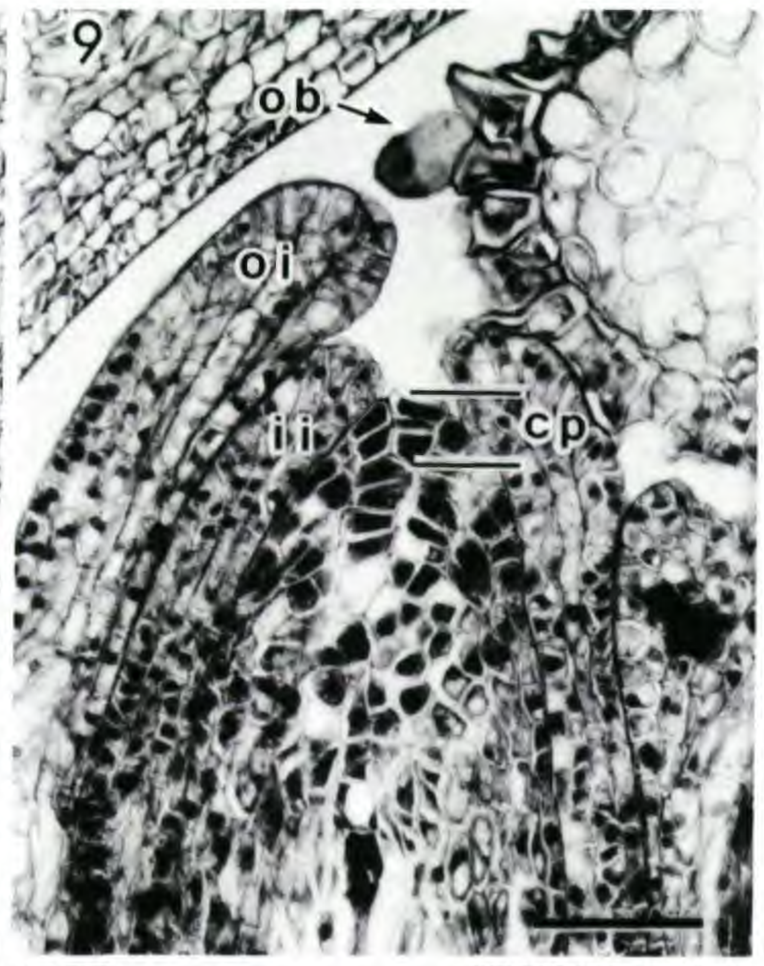
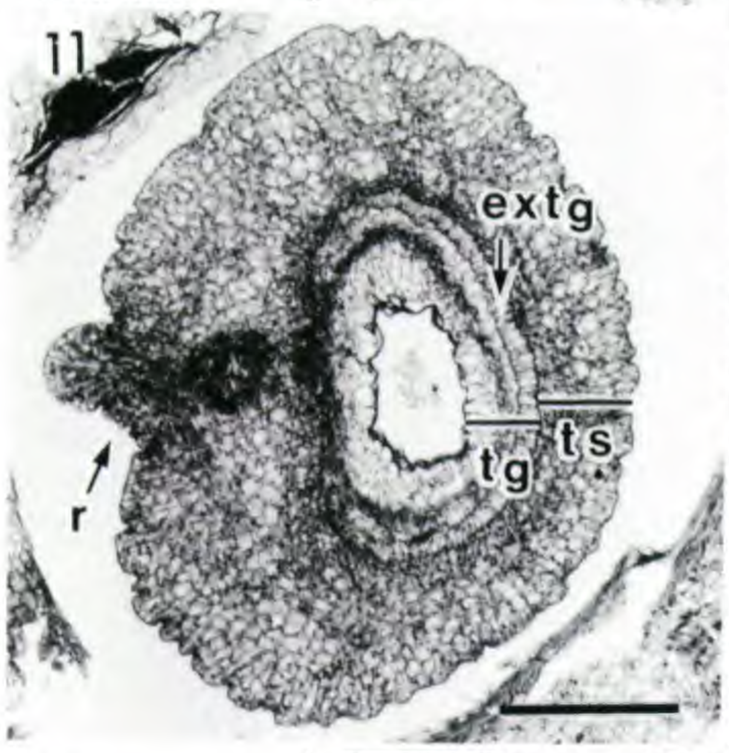
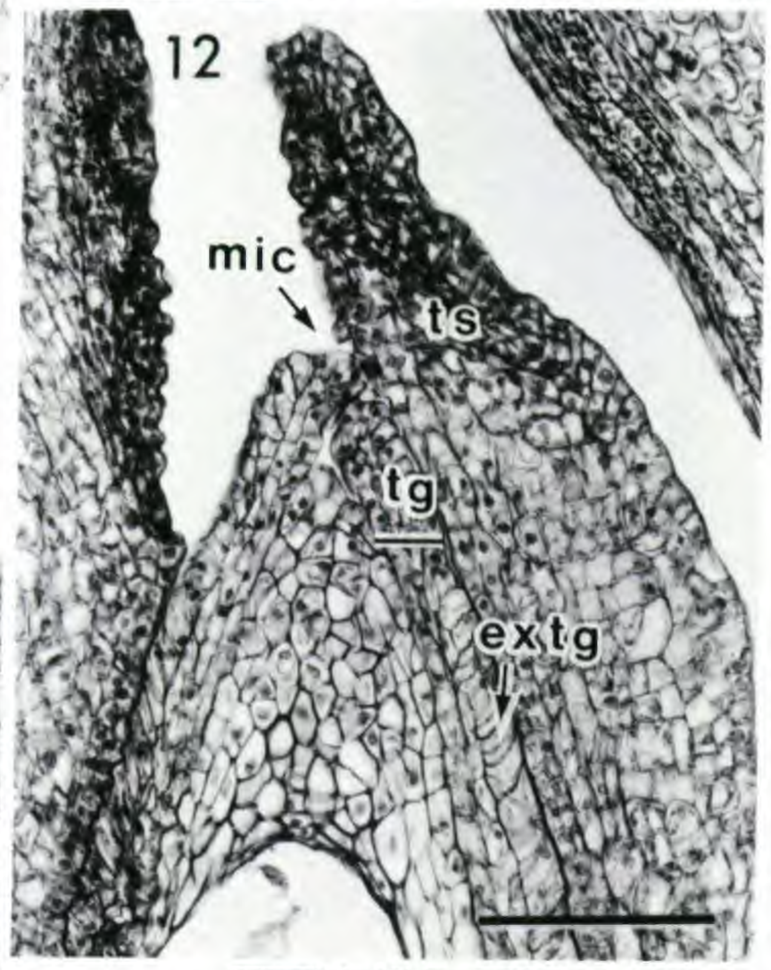
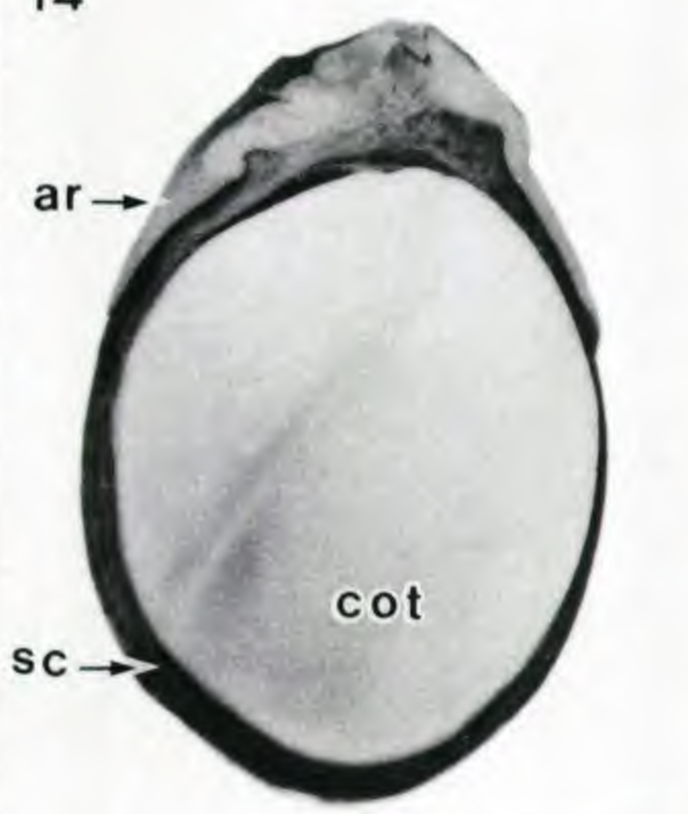


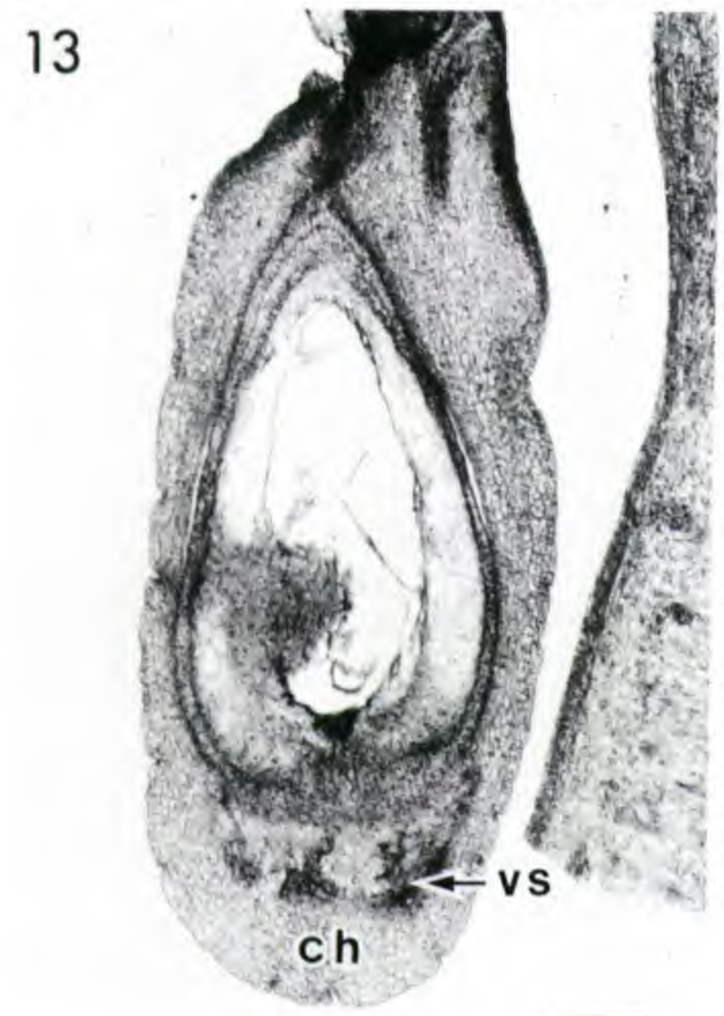
Figure 7. Diagrams illustrating the vascular anatomy of male flower of *Ruptiliocarpon*. —A. Median longitudinal section through the line presented in J. —B–J. Transverse sections at levels marked b–j in A. Sepals and petals are not drawn in H and only stigmas are presented in I. Abbreviations: nc, (nectariferous staminal tube); pe, petal; ps, pistil; se, sepal; st, stamen.

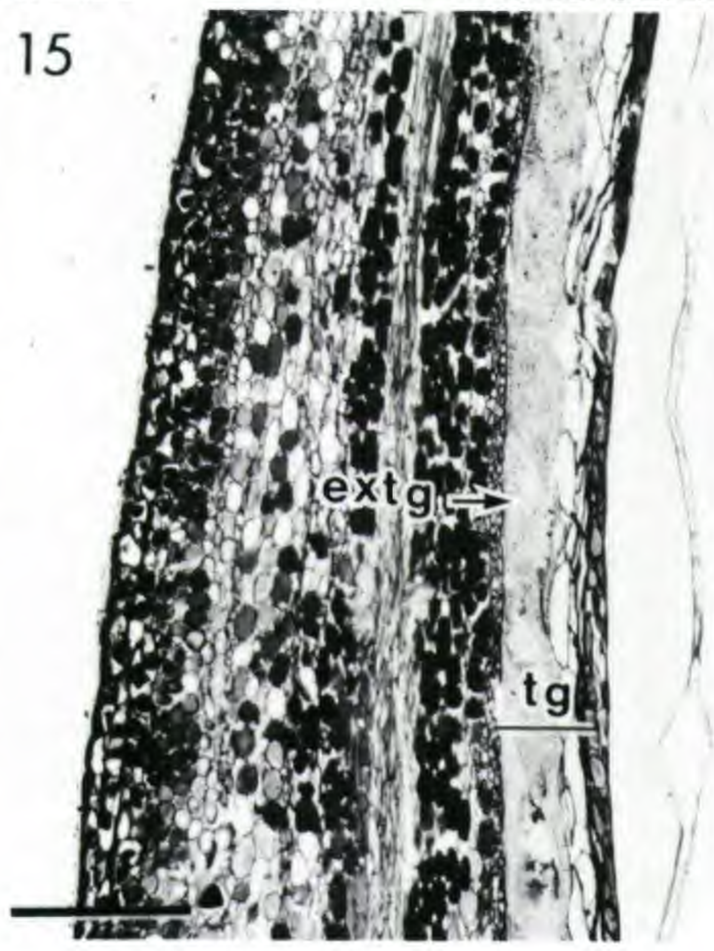


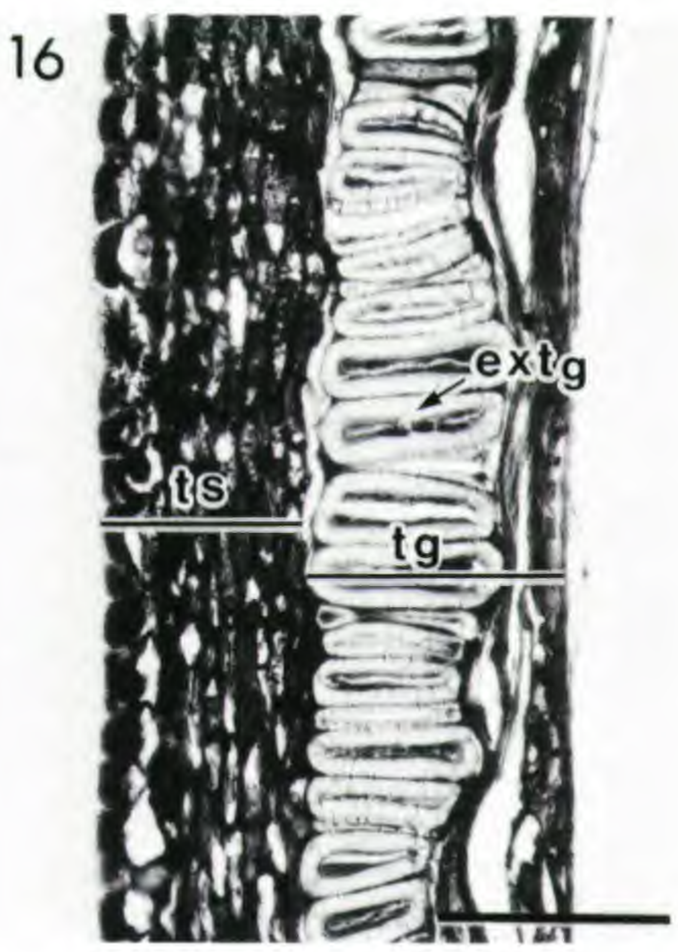












Figures 8–16. Anatomy of ovules and seeds of *Ruptiliocarpon*. —8. Longitudinal section of mature ovule. —9. Longitudinal section of an upper half of mature ovule. —10. Longitudinal section of younger ovule at 4-nucleate embryo sac stage. —11. Transverse section of young seed. —12. Longitudinal section of an upper part of young seed. —13. Longitudinal section of young seed. —14. Half of longitudinally dissected mature seed. —15. Longitudinal section of mature seed coat on raphal side. —16. Transverse section of mature seed coat. Abbreviations: ar, aril; ch, chalaza; cot, cotyledon; cp, nucellar cap; ext, exotegmen; ii, inner integument; mic, micropyle; pc, parietal cell(s); ob, obturator; oi, outer integument; r, raphe; sc, seed coat; tg, tegmen; ts, testa; vs, vascular bundle. Scales equal 10 μm in Figure 7, 50 μm in Figures 8, 9, 100 μm in Figures 11, 15, and 16, 200 μm in Figures 10, 12, and 14, and 5 mm in Figure 13.

sepal generally receives three or more vascular bundles (Fig. 7C, D), while each petal and stamen receives a single vascular bundle (Fig. 7D, E). Vascular bundles enter the base of the ovary arranged in a ring and divide upwardly into ovary wall bundles and axial placental bundles (Fig. 7E–G). In female flowers the ovule supply is provided from the axial bundles to nearly the top of the locule (Fig. 5).

Ovule Morphology and Embryology

Ovules are anatropous, bitegmic and crassinucellate (Figs. 8–10). In the youngest ovules available, a 10-cell-layered parietal tissue is present above the eight-nucleate embryo sac (Fig. 10). A thick, three-cell-layered nucellar cap derived from apical dermal cells of the nucellus is formed (Fig. 9). Both the inner (ii) and outer (oi) integuments are multiplicative; at the mature ovule stage the ii is about four cells thick and oi 7–10 cells thick. A micropyle is formed by the ii and oi together (Fig. 12).

Ovules and young seeds are more or less pachychalazal. A funicular vascular bundle divides at the chalaza, forming a vascular plexus, but none of the vascular branches enters the integuments (Fig. 13). An obturator is formed from funicular tissue near the micropyle (Fig. 9). No hypostase is differentiated.

Seed Anatomy

Mature seeds are ellipsoid, about 17–19 mm long and 11–12 mm in diameter with a funicular aril. They are exalbuminous and contain a straight embryo with massive cotyledons (Fig. 14). The mature seed coat has both testa (developed oi) and tegmen (developed ii) (Fig. 16). Early in development only exotegmic cells are enlarged, while all remaining cells are not specialized (Figs. 11, 12). All constituting cells of the young testa are persistent; at maturity the testa is 8–10 cells thick, comprising small, flattened, tanniniferous cells. Compared to other cells, exotestal cells may be more or less enlarged and have thick outer cell walls. On the other hand, the tegmen of the mature seed is much more specialized, comprising a well-developed fibrous exotegmen and a collapsed but persistent meso-and endotegmen. Cells of the exotegmen are longitudinally elongate, thick-walled, pitted, and up to 70–90 μm thick (Figs. 15, 16).

Discussion

Prior to discovery of the similarity between *Ruptiliocarpon* and the African *Lepidobotrys* search for affinities of *Ruptiliocarpon* concentrated on Sapindales (Hammel & Zamora, 1993; Mennega, 1993). Among Sapindales, *Ruptiliocarpon* coincides with Meliaceae in numerous reproductive characters. In both, flowers are pentamerous with five sepals, five petals, and ten stamens. They have a compound superior ovary with no distinct styles and each of the two locules has two ovules attached near the top of the partition. Filaments are connate to form a staminal tube; ovules are anatropous, bitegmic, and crassinucellate; an obturator and nucellar cap are present; seeds are pachychalazal (less conspicuous in *Ruptiliocarpon*), exalbuminous, arillate (pro parte in Meliaceae), and exotegmen of mature seed coats is fibrous (pro parte in Meliaceae, including some *Trichilia* spp.). *Ruptiliocarpon*, however, appears to differ importantly from Meliaceae with respect to the position of the floral nectary. In *Ruptiliocarpon* the floral nectary is the staminal tube itself, while in Meliaceae it is usually (always?) intrastaminal or gynophoreal and present as a separate disk (Boesewinkel, 1981; Corner, 1976; Nair, 1958, 1959a, b, 1963, 1970; Nair & Kanta, 1961; Narayana, 1958; Pennington, 1981). This and a number of other characters were considered sufficient to exclude *Ruptiliocarpon* from Meliaceae, and describing it in its own family was considered (see Hammel & Zamora, 1993). However, the formerly monotypic Lepidobotryaceae has surfaced as the more logical disposition of *Ruptiliocarpon*.

Since no floral material was available for anatomical analysis of *Lepidobotrys*, the close relationship between that genus and *Ruptiliocarpon* rests on the similarities apparent from examination of herbarium material and the literature, as discussed by Hammel & Zamora (1993). As far as is known from the literature, *Ruptiliocarpon* agrees with *Lepidobotrys* in floral anatomy in much the same way it agrees with Meliaceae. In addition, the floral disk (cf. Léonard, 1950) would appear to be more like the nectariferous staminal tube of *Ruptiliocarpon* than what is known for the Meliaceae. One mature seed of *Lepidobotrys staudtii* Engler (*Etuge & Thomas 478*, MO) was available and examined for comparison. Contrary to some literature reports (e.g., Tisserant, 1949), the mature seeds of *Lepidobotrys* certainly lack endosperm as do those of *Ruptiliocarpon*. The seed coat of *Lepidobotrys* does lack a fibrous exotegmen, present in *Ruptiliocarpon* and thought to be important in its comparison to Meliaceae. However, this character is variable within a number of families, including Meliaceae, and does not necessarily exclude association of *Ruptiliocarpon* with *Lepidobotrys* at the familial level.

The suggestion of a relationship to (but not within)

Euphorbiaceae (Hammel & Zamora, 1993) deserves attention. In terms of ovule and seed morphology and anatomy, *Ruptiliocarpon* agrees well with the primitive subfamily Phyllanthoideae but not with advanced members of the Euphorbiaceae. A fibrous exotegmen, which has sometimes been considered significant for determining relationships, is found in quite a few genera of Phyllanthoideae (Corner, 1976). Nevertheless, a more definite resolution of the affinities of Lepidobotryaceae (*Lepidobotrys* and *Ruptiliocarpon*) must await examination of floral and young fruiting material of *Lepidobotrys*.

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Rahowardiana globifera (Solanaceae), a New Species from Colombia

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ABSTRACT. *Rahowardiana globifera*, newly described from Antioquia, Colombia, is a second species for this striking, high-climbing solanaceous genus.

Rahowardiana is a small group of relatively rare epiphytic shrubs first described from Panama (D'Arcy, 1973: 670). It is a member of tribe Juanulloeae, whose members are all neotropical woody epiphytes. *Rahowardiana* is most closely related to *Juanulloa*, sharing with that genus narrow tubular flowers and highly branched inflorescences. Work in progress by V. Persson, S. Knapp & S. Blackmore suggests the genera share several pollen characters. *Rahowardiana* is distinctive, however, in its congested globose inflorescence with highly contrasting corollas and calyces.

Rahowardiana globifera Knapp & D'Arcy, sp. nov. TYPE: Colombia. Antioquia: Parque Nacional Natural "Las Orquídeas," Sector Venados, 890 m, 6°33′N, 76°19′W, 1 Apr. 1988 (fl, fr), *Cogollo, Ramirez & Alvarez 2895* (holotype, JAUM-018167; isotypes, COL not seen, FMB not seen, MO). Figure 1.

Frutex scandens, foliis obovatis coriaceis magnis petiolatis. Inflorescentia congesta globosa, pedicellis brevis. Flores calycibus tubulosis, coriaceis purpurea, corollis albis, antheris linearis. Bacca anguste turbinata.

High-climbing, unarmed, scandent shrub, twigs stout, drying strongly angled; pubescence (seen only on leaf undersides) of slender, erect, weak, collapsing, simple, uniseriate hairs 3–5 cells long, the distal cells smaller. Leaves obovate, 15–30 × 10–21 cm, apically rounded, basally obtuse, veins obscure above, prominently elevated beneath, the lateral veins 4 on each side, looping and anastomosing 5–10 mm from the margin, the minor venation mostly perpendicular, the margins slightly revolute, subcoriaceous, concolorous, glabrous above, beneath softly and evenly pubescent; petioles drying dark, 15–25 mm long, ca. 5 mm thick, drying longitudinally ridged and crossed with numerous transverse fissures. Inflorescence a condensed, crowded, globose panicle or raceme ca. 15 cm long, forming spheres ca. 35 cm diam.; peduncle not evident, pedicels stout, ca. 5 mm long, glabrous. Flowers with calyx purple, tubular, strongly angled, 7–8 cm long, ca. 15 mm wide apically, coriaceous, irregularly sinuate lobed, the tips of the lobes green; corolla white, the tips of the lobes purple dorsally, ca. 6.5 cm long (immature), the lobes 0.5–1 cm long; stamens 5, the filaments straight, glabrous, inserted at or near the base of the corolla tube, anthers linear, ca. 15 mm long, 2–3 mm wide, yellow, the connective drying dark, the thecae confluent at the apex, dehiscing longitudinally; ovary pale brown, conical, ca. 1 cm long, narrowly beaked, glabrous, surmounting a distinct, slightly lighter colored, slightly undulating annular nectary, style white, markedly different in color from the ovary, straight, 5–6 cm long, stigma strongly bifurcate, the lobes ca. 1 mm long, minutely papillate. Fruit a pale yellow, narrowly ovoid berry, ca. 9.5 cm long, basally 1 cm wide, expanding to ca. 2 cm wide about 4 mm from the base, then narrowing into a slender beak 4–5 cm long; seed fabiform, ca. 6 × 3.5 mm, tan colored, the surface minutely pitted.

Rahowardiana globifera resembles *Rahowardiana wardiana* D'Arcy, from Panama. It differs in its stouter twigs; larger, more coriaceous leaves, which are puberulent beneath; in its short pedicels; larger calyces; white instead of yellow flowers; and larger fruit. The inflorescences of this species are twice or three times as large as those of *R. wardiana*.

Recent collecting in northwestern Colombia has uncovered many interesting new plants, one of which is described here. The collecting area, Parque Nacional "Las Orquídeas," is on the Pacific slope of the Western Cordillera, an area of high rainfall and high relief. This species was found in premontane rainforest, climbing in the overstory within hand's reach. It is locally abundant, and the large, unusual inflorescences can be seen at a distance (Cogollo, pers. comm.).

NOVON 3: 429–430. 1993.

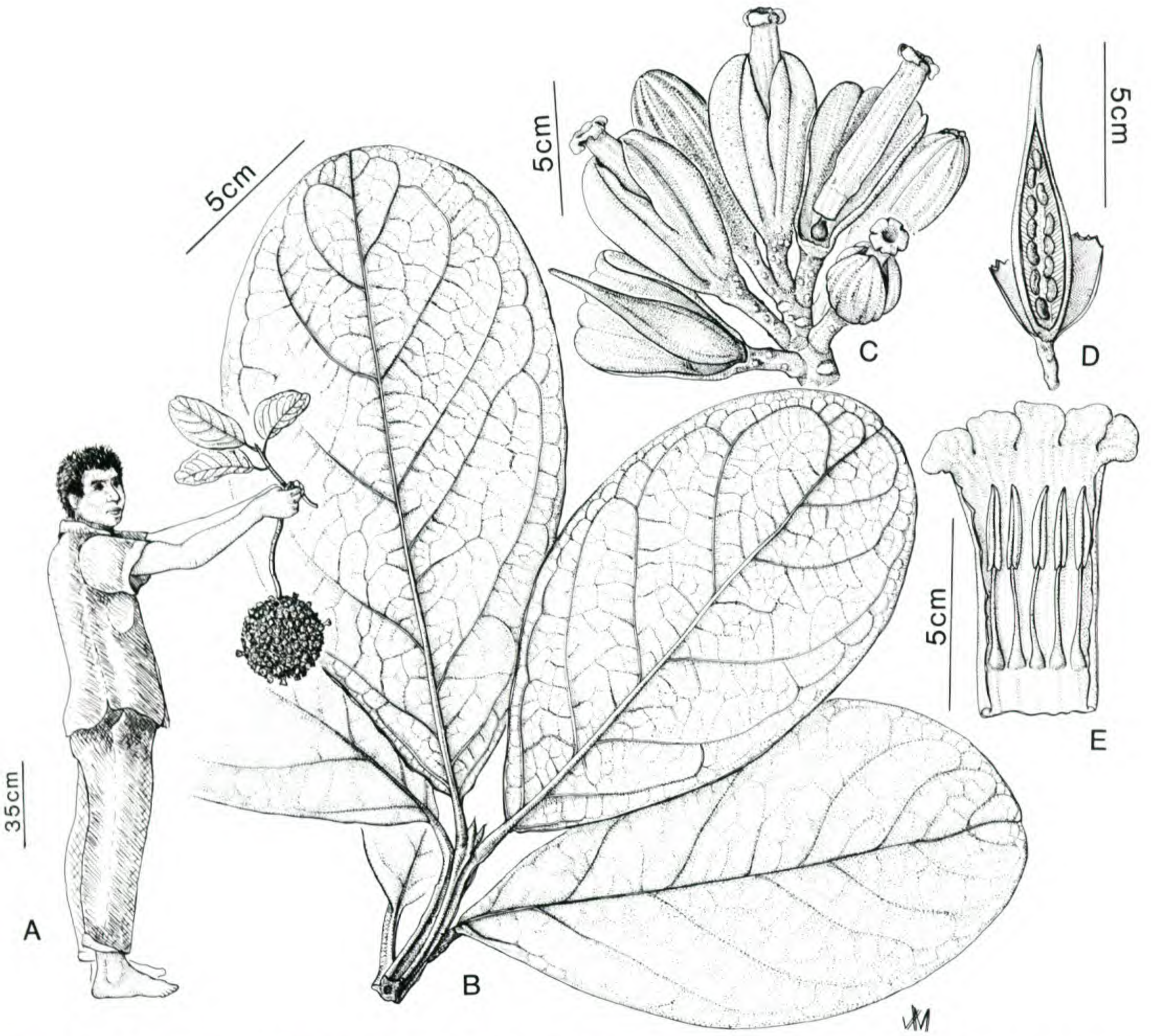

Figure 1. *Rahowardiana globifera* Knapp & D'Arcy (*Cogollo, Ramírez & Alvarez 2895*, MO). —A. Twig with leaves and pendent inflorescence. —B. Twig with leaves. —C. Portion of inflorescence showing flowers and fruit. —D. Fruit, opened to show seeds. —E. Corolla opened to show stamens.

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A New Species of *Cyanea* (Campanulaceae: Lobelioideae) from Kaua'i, and the Resurrection of *C. remyi*

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ABSTRACT. Two species are added to *Cyanea*, both endemic to Kaua'i. One is new, based on a recently collected specimen. The other was described previously but excluded from the most recent account of the genus due to the inadequacy of the available material. It is reinstated on the basis of data obtained from several newly collected specimens. The genus now includes 56 species and nine heteronymic subspecies.

Cyanea Gaudichaud (Campanulaceae: Lobelioideae) is a genus of trees and shrubs endemic to the Hawaiian Islands. Lammers's (1990) treatment of the genus for the *Manual of the Flowering Plants of Hawai'i* included 52 species and nine heteronymic subspecies. Recently, Lammers (1992) added two species from Kaua'i to the genus. In the present paper, *Cyanea* is further enlarged by the addition of two more species from Kaua'i. One is newly described; the other is a previously described species that was not recognized in the *Manual* because of the inadequacy of the available material. As such, *Cyanea* now includes a total of 56 species and nine heteronymic subspecies.

Both of these species were collected at a relatively inaccessible locality known as "The Blue Hole." This site, located east of Kaua'i's center at the headwaters of the Wailua River, is a deep and extremely wet valley head surrounded on three sides by vertical cliffs 900 m high and laced with waterfalls. The vegetation here is an unusual mix of shrubland and low rainforest on saturated rocky ground. The canopy is just 1–3 m tall, and the ground layer is rich in pteridophytes.

A brief comment on the spelling of Hawaiian place names in the specimen citations is in order. The spellings adopted here are those given by Pukui et al. (1974), in which the macron (¯) is used to indicate long vowels and the hamza (') to indicate glottal stops. Although non-Polynesian authors are often tempted to omit these diacritical marks, doing so is a grammatical gaffe comparable to omitting the umlauts from German words or the tildes from Spanish ones.

NEW SPECIES

During an excursion into the Blue Hole in June 1990, Steve Perlman collected a *Cyanea* with very unusual leaves. The lamina was less than three times as long as wide, cordate at base, and only half as long as the petiole. Nearly all species of *Cyanea* have leaves in which the lamina is several to many times longer than wide; attenuate, cuneate, obtuse, truncate, or rounded at base; and much longer than the petiole. The sole exception is the aptly named *C. asarifolia* H. St. John, which is endemic to eastern Kaua'i and also occurs in the Blue Hole. However, the unidentified *Cyanea* differed from *C. asarifolia* by having the lamina ovate or oblong (vs. cordiform), 3.7–5.8 (vs. 7–8) cm wide, twice as long as wide (vs. almost as wide as long), with scattered hairs along the midrib on the lower surface (vs. glabrous), the margin callose-serrulate (vs. minutely callose-crenulate), the base often markedly asymmetric (vs. symmetric); and by having the inflorescences 8–11-flowered (vs. 30–40-flowered), sparsely pubescent (vs. glabrous), the peduncle 4–4.5 (vs. 2.5–3) cm long, the pedicels 12–15 (vs. 7–10) mm long, and the bracts 5–7 (vs. 1.5) mm long.

Perlman was able to locate only a single large individual just beginning to flower plus three juveniles. Despite the lack of mature flowers and fruit, it is clear that these plants cannot be referred to any previously described member of the Lobelioideae and that they represent an undescribed species. We realize that publishing a novon on the basis of a single immature specimen is a less than commendable practice. However, extenuating circumstances dictate timely publication in this case. First, fertile material is not likely to become available anytime in the foreseeable future. A survey of the type locality in October 1992, six weeks after Hurricane

Iniki struck Kaua'i, revealed that all known individuals of this species had been destroyed by the hurricane. Although it is likely that additional plants survive on the cliffs surrounding the Blue Hole, the vertical aspect and great height of these cliffs renders them virtually impossible to explore. Second, because of its apparent rarity, this species merits protection under the Endangered Species Act of 1973. However, to be listed, it must first "exist," i.e., be described and have a name.

Cyanea dolichopoda Lammers & Lorence, sp. nov. TYPE: Hawaii. Kaua'i: Blue Hole, N fork of Wailua River, S side of Blue Hole, *Metrosideros polymorpha* lowland wet shrubland with *Pipturus, Cyrtandra, Touchardia, Cyanea asarifolia, Lysimachia filifolia, Hedyotis elatior*, 1 June 1990, *S. Perlman 11070* (holotype, PTBG). Figure 1.

A *Cyanea asarifolia* laminis ovatis, duplo longioribus quam latioribus, 3.7–5.8 cm latis, pubescentibus in pagina inferna secus costam, margine calloso-serrulato, basi saepe asymmetrica; et inflorescentiis 8–11-floris, pubescentibus, pedunculis 4–4.5 cm longis, pedicellis 12–15 mm longis, bracteis 5–7 mm longis differt.

Shrub, 1 m tall; stem unbranched, erect, unarmed, glabrous. Lamina ovate or oblong, 6.5–10 cm long, 3.7–5.8 cm wide; upper surface green, glabrous; lower surface light green, with scattered hairs along the midrib; margin callose-serrulate; apex acute or obtuse; base cordate, often markedly asymmetric; petiole 9–16 cm long, slender, glabrous. Inflorescence (not fully expanded) spreading or pendent, 8–11-flowered, sparsely pubescent; peduncle 4–4.5 cm long, slender; rachis 2–2.7 cm long; bracts linear, 5–7 mm long; pedicels 12–15 mm long, spreading, bibracteolate at the middle; bracteoles linear, 7.5–8 mm long. Corolla (in bud) pinkish, glabrous. Fully expanded flowers, fruits, and seeds not seen.

Distribution, Habitat and Phenology. Cyanea dolichopoda is known only from the relatively inaccessible type locality on Kaua'i, where it grew on a cliff face at ca. 700 m elevation (S. Perlman, pers. comm.). Judging from the size of the flower buds, anthesis might be expected to commence in middle to late June.

Etymology. The specific epithet was coined by combining the Greek words *dolichos*, long, and *podion*, foot, in reference to both the long peduncles and the long petioles.

Relationships. Both *Cyanea dolichopoda* and its close relative *C. asarifolia* are members of section *Delisseoideae* (Hillebrand) Rock. This group includes about a dozen species and is found on all of the main Hawaiian Islands but Hawai'i. The *Delisseoideae* are characterized by their shrubby habit, relatively slender unarmed stems, entire or minutely toothed petiolate leaves, typically glabrous flowers, hypanthium 2–6(–8) mm long, calyx lobes typically dentiform, 0.5–1 mm long, and corollas 15–30(–40) mm long, with lobes about as long as the tube. In the treatment of *Cyanea* in the *Manual, C. dolichopoda* would key with difficulty to *C. asarifolia*, from which it may be distinguished by the characters given above.

Resurrection of *Cyanea remyi* Rock

In addition to *C. dolichopoda*, botanists exploring the Blue Hole collected a second unusual species of *Cyanea*. This plant was present in larger numbers, with a total of three healthy populations numbering approximately 200 individuals scattered in the understory at 600–730 m elevation (S. Perlman and K. Wood, pers. comm.).

Similar plants were encountered in south-central Kaua'i, some 9–10 km south of the Blue Hole, in the Wahiawa Mountains and the drainage of Wahiawa Stream, during a botanical inventory of that region. The rugged mountainous terrain of this bowl-shaped region is dissected by numerous stream systems and covered by lowland rainforest and boggy shrubland. Six populations of the unidentified plant, numbering 110 juveniles and adults in all, were encountered here at elevations of 660–780 m in forest understory (Lorence & Flynn, 1991).

Most recently, this same unidentified species was encountered in northern Kaua'i at the headwaters of Wai'oli Stream. Here, two sterile plants were discovered in the understory of lowland rainforest at 370 m elevation (S. Perlman and K. Wood, pers. comm.). This third site is located approximately 11 km north of the Blue Hole and 20 km north of the Wahiawa Mountains.

The plants from these three localities could not be referred to any species of *Cyanea* described in the *Manual* and were thought by their collectors to represent a species new to science. However, when specimens were shown to the senior author in 1989, he suggested that they might represent *C. remyi*, which had not been included in the *Manual.* This species had been described by Rock (1919) on the basis of a single specimen deposited at Paris, which had been collected on "Kauai ou Nihau" (i.e., Kaua'i or Ni'ihau) sometime during the early 1850s by Jules Rémy. This specimen, which the senior author had examined at Paris in 1987, consisted of a single stem bearing a few large leaves, two inflorescences

Figure 1. *Cyanea dolichopoda* Lammers & Lorence, apex of plant; inset shows portion of leaf margin, enlarged (from the holotype).

with immature flower buds, plus a detached inflorescence apex (cf. Rock, 1917: pl. 12; 1919: pl. 158).

In the 130 years following Rémy's visit, *C. remyi* was collected just once more. In 1916, C. N. Forbes gathered sterile specimens of an unknown *Cyanea* in the Hi'i (Wahiawa) Mountains of Kaua'i. It was subsequently identified as *C. remyi* by Wimmer (1943).

In preparing the treatment for the *Manual*, the senior author of the present paper came to essentially the same conclusion regarding *C. remyi* as Wimmer (1943: 78), who commented "Species non satis nota et eius positio dubia." With only the incomplete holotype and Forbes's sterile gathering at hand, it was not possible to characterize the species adequately and to include it in the dichotomous key. Instead, *C. remyi* was merely mentioned in the discussion under *C. truncata* (Rock) Rock, a species with leaves that are somewhat similar in size and shape.

In order to determine whether the unidentified plants were referable to *C. remyi*, the holotype was borrowed and examined by both authors in 1991. After a thorough comparison, there was no doubt that the recent collections from all three localities on Kaua'i, as well as Forbes's 1916 collection, were in fact all referable to that species. The holotype and Forbes's specimen fell well within the range of variation seen within and among the three extant populations. As a result, *C. remyi* is here resurrected and described more fully on the basis of the flowering and fruiting material now available.

Cyanea remyi Rock, Bull. Torrey Bot. Club 44: 233. 1917. *Delissea remyi* (Rock) H. St. John, Phytologia 63: 87. 1987. TYPE: Hawaiian Islands, "Kauai ou Nihau," 1851–55, *J. Rémy 302bis* (holotype, P). Figure 2.

Shrub, 0.9–2 m tall; stem unbranched (occasionally with 1 or 2 branches from base), 1–2.5 cm diam., erect, unarmed, dark purple and pubescent toward apex, brown and glabrous below; latex light yellow (occasionally white), thin. Lamina broadly elliptic, ovate, or broadly oblong, 16–40 cm long, 9.5–19.5 cm wide; upper surface green, glossy, glabrous, the midrib maroon or dark purple at least in the lower ⅓; lower surface whitish green, glossy, with scattered short white hairs on the midrib and veins; margin minutely callose-denticulate; apex obtuse, acute, acuminate, or cuspidate; base subcordate, truncate, rounded, or obtuse; petiole 8–20 cm long, 2–5 mm diam., maroon or dark purple, glabrous or pubescent with short white hairs. Inflorescence ascending, 6–13-flowered, pubescent with short white hairs; peduncle 4–8 cm long, 2–4 mm diam., maroon or dark purple; rachis 0.5–2 cm long, maroon or dark purple; bracts linear, 3 mm long, 0.6 mm wide, deciduous; pedicels 10–21 mm long, bibracteolate at or below the middle, maroon or dark purple; bracteoles linear, 1–3 mm long. Hypanthium obovoid or obconic, 9–12 mm long, 5–9 mm diam., dark purple, pubescent with short white hairs. Calyx lobes triangular or narrowly triangular, spreading or ascending, 4–6 mm long, 1–2 mm wide, dark maroon; apex acute. Corolla bilabiate, 40–53 mm long, dark purple, shading to purplish white at the apex of the lobes on their inner surface, densely pubescent with short white hairs; tube curved, 30–31 mm long, 5–5.5 mm diam., cleft dorsally for ca. ½ its length; dorsal lobes linear, spreading and slightly recurved, 19–22 mm long, 2–2.5 mm wide, acute at apex; ventral lobes linear, spreading and slightly recurved, 15–20 mm long, 2–2.5 mm wide, acute at apex. Staminal column slightly exserted; filaments 32–40 mm long, purplish white, glabrous; anther tube 10–11 mm long, 2 mm diam., purplish white, the lower 2 anthers with tufts of white hairs at apex, otherwise glabrous. Berry spherical, 10–13 mm long, 10–13 mm diam., maroon or dark purple with orange flesh, tuberculate. Seeds minute, black or dark brown, smooth, shining. Chromosome number (M. Kiehn, pers. comm.) $2n = 28$.

Distribution, Habitat and Phenology. Extant populations are known from three localities on Kaua'i, in the upper reaches of the Wailua River, Wahiawa Stream, and Wai'oli Stream. The plants occur on wet seeping or saturated rocky substrates in areas of rainforest and shrubland at 370–770 m. Flowering specimens were collected in June, July, and September, and fruiting ones in September, November, and April.

Although the holotype is labeled "Kauai ou Nihau," *C. remyi* is here considered to be endemic to the former. Certainly, the extreme wetness of the known localities, as well as their elevational range, suggests that the holotype could not have been collected on the much drier island of Ni'ihau, which is just 390 m above sea level at its highest point.

Etymology. This species commemorates French naturalist and traveler Ezechiel Jules Rémy (1826–1893), who collected several hundred botanical specimens in the Hawaiian Islands during the early 1850s.

Additional specimens examined. HAWAII. **Kaua'i:** Hanalei District, Wai'oli Stream, back of valley, *Wood & Perlman 1494* (PTBG); boundary of Līhu'e and Ka-

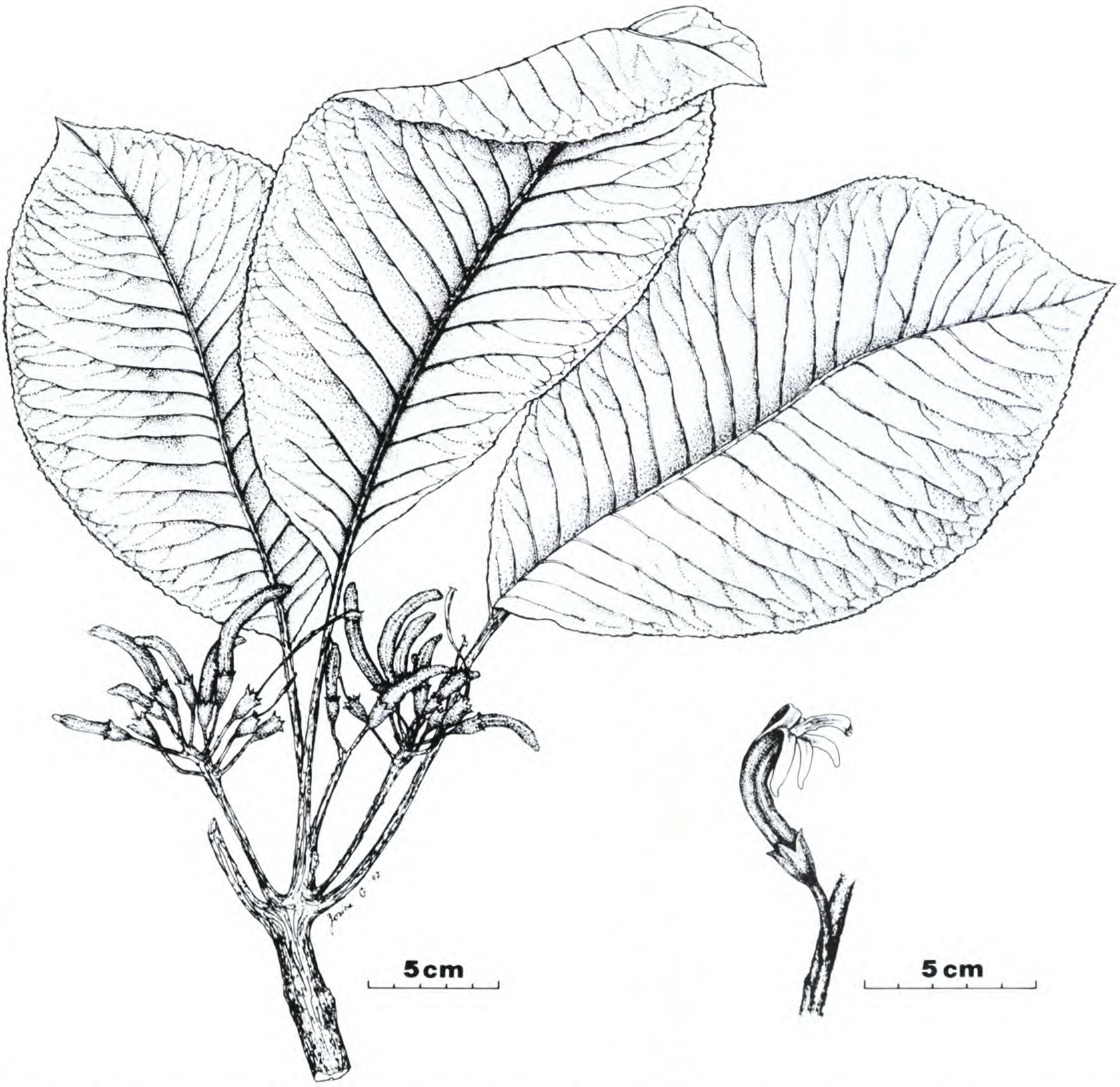

Figure 2. *Cyanea remyi* Rock, apex of plant (based on *Wood et al. 0098*); inset shows single flower, enlarged slightly (based on *Lorence et al. 6592* and on a color transparency by D. H. Lorence).

waihau districts, headwaters of N fork of Wailua River, area called "The Blue Hole" or "The Crater," *Lorence et al. 5327* (F, PTBG), *Wood et al. 0098* (F, PTBG), *Wood et al. 0352* (PTBG), *Lorence et al. 6561* (F, PTBG), *Lorence et al. 6565* (F, PTBG), *Flynn et al. 3990* (PTBG), *Lorence et al. 6592* (PTBG), [voucher for chromosome count] *Kiehn 900823-1/5* (WU not seen), *Wood et al. 1125* (PTBG), *Wood et al. 1114* (PTBG), *Wood & Perlman 1353* (PTBG); Hi'i Mts., *Forbes 660.K* (B, BISH); Līhu'e-Kōloa F. R., Wahiawa Mts., just NE of Wahiawa Bog, along N fork of Wahiawa Stream, NW of Mt. Kāhili, *Lorence et al. 5949* (BISH, PTBG), *Wagner et al. 6061* (BISH not seen), *Wood et al. 0544* (PTBG); Līhu'e-Kōloa F. R., Wahiawa Mts., W ridge, below rope trail, *Wood et al. 1206* (PTBG); Līhu'e-Kōloa F. R., Wahiawa Mts., NW of Wahiawa Bog, along tributary of Wahiawa Stream, NW of stream and SE of Hulua, *Flynn & Wood 3237* (PTBG), *Flynn & Wood 3238* (PTBG); Līhu'e-Kōloa F. R., Wahiawa drainage, *Flynn et al. 4493* (PTBG); Līhu'e-Kōloa F. R., W side of Wahiawa drainage, below ridge between Hulua and Pu'uau'uka, *Wood et al. 1365* (PTBG).

Relationships. Cyanea remyi is referable to section *Hirtellae* Rock, a group of eight species endemic to Kaua'i, which is characterized by shrubby habit, relatively slender unarmed stems, entire or minutely toothed petiolate leaves, densely pubescent flowers, hypanthium 6–11 mm long, calyx lobes triangular, 1–5(–16) mm long, and corollas 25–53 mm long, with lobes about as long as the tube. *Cyanea remyi* may be incorporated into Lammers's (1992) key to the species of *Hirtellae* by appending the following couplet to the beginning of that key:

0a. Lamina ovate, broadly elliptic, or broadly oblong, the base subcordate, truncate, rounded, or obtuse; petiole 8–20 cm long ..... *C. remyi*
0b. Lamina narrowly elliptic, obovate, oblanceolate, or oblong, the base attenuate or cuneate (rarely obtuse); petiole 0.5–9 cm long ..... (remainder of *Hirtellae*).

In the *Manual*, *C. remyi* would key with some difficulty to *C. sylvestris* A. Heller, another member of the *Hirtellae*. The two species are similar in their relatively wide leaves (typically more than 6 cm wide), ascending peduncles, and large flowers (corolla more than 4 cm long). However, *C. remyi* differs from *C. sylvestris* in its shorter stature (0.9–2 m vs. 1.5–6 m tall) and in having the lamina ovate, broadly elliptic, or broadly oblong (vs. obovate or oblanceolate) and subcordate, truncate, rounded, or obtuse (vs. cuneate) at base; petioles 8–20 (vs. 2.5–8) cm long; peduncles 4–6.5 (vs. 1–4) cm long; corolla dark purple (vs. white with longitudinal purple stripes); and berries spherical (vs. obovoid), 10–13 (vs. 7–10) mm in diameter, maroon or dark purple (vs. orange or yellow).

Cyanea truncata, the species under which *C. remyi* was previously discussed (Lammers, 1990), is a member of section *Cyanea*. It differs from *C. remyi* by having its stems and petioles muricate; lamina obovate, with a cuneate or truncate base; inflorescences horizontal or pendent; bracts narrowly oblong, 9–20 mm long; hypanthium 5–6 mm long; calyx lobes narrowly oblong, obtuse at apex; corolla 32–42 mm long, the lobes only ¼–½ as long as the tube; and berries orange, 8–10 mm long, 8–10 mm in diameter. Additionally, it is known only from O'ahu.

Acknowledgments. The curators of BISH and P are acknowledged for the loan of specimens. Lammers's visit to B and P in 1987 was supported by a Graduate Student Alumni Research Award from The Ohio State University. We are grateful to Tim Flynn, Steve Perlman, and Ken Wood for providing information on population sizes and other field observations; Zorica Dabich for preparing the illustrations; and Michael Kiehn for permission to publish his chromosome number determination for *C. remyi*.

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Merger of the Endemic Hawaiian Genera *Cyanea* and *Rollandia* (Campanulaceae: Lobelioideae)

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ABSTRACT. Phylogenetic analyses based on molecular data indicate that the species of *Rollandia* are embedded within the genus *Cyanea* and that together these genera form a monophyletic group. *Cyanea* and *Rollandia* are therefore merged under the former name. A revised key to the baccate genera of Hawaiian Lobelioideae and an expanded description of the genus are provided; eight new combinations and one new name are proposed; and lectotypes are selected for *Rollandia humboldtiana* and *R. longiflora* var. *angustifolia*. This expanded circumscription makes *Cyanea* the largest genus in the Hawaiian flora, with 64 species and 10 heteronymic subspecies.

The flora of the Hawaiian Islands includes 114 endemic species of woody Lobelioideae (Campanulaceae), 95 of which have baccate fruits (Lammers, 1990, 1992a; Lammers & Lorence, 1993). Traditionally (Gaudichaud, 1826; Bentham & Hooker, 1876; Hillebrand, 1888; Schönland, 1889; Rock, 1919; Wimmer, 1943), these baccate species have been divided among four genera: *Clermontia* Gaudichaud, *Cyanea* Gaudichaud, *Delissea* Gaudichaud, and *Rollandia* Gaudichaud. However, various alternative classifications have been proposed. Presl (1836) and de Candolle (1839) recognized a fifth genus, *Macrochilus* C. Presl. Gray (1861), however, recognized only three; *Macrochilus* was included in *Cyanea* and the species of *Rollandia* were divided between *Cyanea* and *Delissea*. Endlicher (1836) and Dietrich (1839), taking a very broad view of generic circumscription, assigned all Hawaiian lobelioids to cosmopolitan *Lobelia* L. Baillon (1885), on the other hand, treated the baccate Hawaiian species as a single genus, *Delissea*, with the four traditional genera as sections. The classification of von Post and Kuntze (1903) was similar, except *Rollandia* was maintained as distinct. St. John (1987) merged *Cyanea* and *Delissea* under the latter name, but maintained *Clermontia* and *Rollandia* as distinct genera. The traditional four-genus classification was employed in the most recent taxonomic summary of the Hawaiian Campanulaceae (Lammers, 1990).

Recent phylogenetic analyses based on restriction site variation in the chloroplast DNA of Hawaiian lobelioids (Givnish et al., in press) have shown that the species comprising *Rollandia* are embedded within *Cyanea* as traditionally circumscribed, that *Cyanea* without *Rollandia* is paraphyletic, and that the two genera together form a monophyletic group. Specifically, *Rollandia* is part of a major clade that is defined by 10 synapomorphic mutations and generally characterized by orange fruits and an unbranched habit. Within this major clade, *Rollandia* forms an unresolved clade defined by three mutations.

Morphologically, the two genera are very similar. Every author for over 100 years has distinguished *Rollandia* solely on the basis of a single feature, i.e., the adnation of the staminal column to the corolla (Hillebrand, 1888; Schönland, 1889; von Post & Kuntze, 1903; Rock, 1919; Wimmer, 1943; Lammers, 1990). The traditional classification of Campanulaceae includes several such cases of closely related genera distinguished by a single morphological feature, e.g., *Campanumoea* Blume and *Codonopsis* Wallich, *Lobelia* and *Pratia* Gaudichaud. The circumscription of such genera must be revised if a natural classification of the family is ever to be achieved (Lammers, 1992b, c).

In order to provide a more natural classification of the baccate Hawaiian lobelioids, *Cyanea* and *Rollandia* are here merged. Although Gray (1861) transferred some species of *Rollandia* to *Cyanea*, the species that was later designated as the lectotype of the genus (*R. lanceolata*) was assigned to *Delissea*. Because no previous author has effectively merged just *Cyanea* and *Rollandia*, and because the two generic names are of equal priority, we have the prerogative of choosing the name to be retained.

We here choose *Cyanea*, as doing so will require far fewer nomenclatural innovations.

The eight species of *Rollandia* (one comprising two subspecies) recognized by Lammers (1990) are here transferred to *Cyanea* with no change in their circumscription or rank. In addition, lectotypes are designated for two inadequately typified names. Descriptions, distributional and habitat data, and lists of heterotypic synonyms are found in Lammers's (1990) treatment and will be amplified in the forthcoming monograph of *Cyanea* (Lammers, in prep.). Assignment of these species to an infrageneric taxon within *Cyanea* is problematic. As noted previously (Lammers, 1990), the infrageneric classification of *Cyanea* is badly in need of revision. The genus has been divided into either three (Hillebrand, 1888; Wimmer, 1943; St. John, 1969) or five sections (Rock, 1919; Stone, 1967). Neither classification maps cleanly onto the molecular clades defined by Givnish et al. (in press); for example, *Cyanea* sect. *Palmiformes* (Hillebrand) Rock comprises species belonging to at least three different clades. A definite infrageneric assignment is deferred, therefore, pending completion of a comprehensive reevaluation of relationships within the enlarged *Cyanea*.

This merger makes *Cyanea* the largest genus in the Hawaiian flora, with 64 species and 10 heteronymic subspecies (Wagner et al., 1990; Lammers & Lorence, 1993). A morphological description of the newly enlarged genus is provided below, as is a revised key to all of the Hawaiian genera of Lobelioideae with baccate fruit. Both are adapted from Lammers (1990).

A brief comment on the spelling of Hawaiian place names in the specimen citations is in order. The spellings adopted here are those given by Pukui et al. (1974), in which the macron (¯) is used to indicate long vowels and the hamza (ʻ) to indicate glottal stops. Although non-Polynesian authors are often tempted to omit these diacritical marks, doing so is a grammatical gaffe comparable to omitting the umlauts from German words or the tildes from Spanish ones.

Revised Key to the Baccate Hawaiian Genera of Lobelioideae

1a. Stems repeatedly branched, spreading; inflorescences (1–)2–3(–10)-flowered; corolla cleft dorsally nearly to base ..... *Clermontia*

1b. Stems unbranched or only sparingly branched, erect or ascending; inflorescences (3–)5–25(–40)-flowered; corolla cleft to about the middle.

2a. Corolla with a small knob at the terminus of the dorsal cleft, sometimes with two additional lateral knobs; seeds 0.7–1.5 mm long, white, dull, conspicuously transversely rugose ..... *Delissea*

2b. Corolla smooth or rarely muricate, without definite dorsal or lateral knobs; seeds 0.2–0.5(–2) mm long, dark brown to black, shiny, smooth or microscopically foveate-reticulate ..... *Cyanea*

Cyanea Gaudichaud, Voy. Uranie 457. 1829. *Delissea* sect. *Cyanea* (Gaudichaud) Baillon, Hist. Pl. 8: 364. 1885. *Kittelia* H. G. L. Reichenbach, Handb. Nat. Pfl.-Syst. 186. 1837, nom. illeg. TYPE: *Cyanea grimesiana* Gaudichaud.

Rollandia Gaudichaud, Voy. Uranie 458. 1829, syn. nov. *Delissea* sect. *Rollandia* (Gaudichaud) Baillon, Hist. Pl. 8: 364. 1885. TYPE: *Rollandia lanceolata* Gaudichaud (selected by Rock (1919: 363)).

Macrochilus C. Presl, Prodr. Monogr. Lobel. 47. 1836. TYPE: *Macrochilus superbus* (Chamisso) C. Presl (based on *Lobelia superba* Chamisso).

Shrubs, treelets, or trees, rarely lianas, terrestrial or rarely epiphytic; stems unbranched or sparingly branched, erect or ascending, unarmed, muricate, or aculeate (more so in juveniles), with numerous helically arranged leaf scars near apex; pith solid or chambered; latex white, yellow, or tan, viscous. Leaves alternate, petiolate or sessile, glabrous or pubescent, sometimes muricate or aculeate, especially on the petiole; margin entire, callose-toothed, or pinnately lobed, cleft, parted, or divided (more so in juveniles), the lobes or segments then entire, callose-toothed, lobed, or divided. Inflorescences axillary, racemose, (3–)5–25(–40)-flowered, the rachis sometimes obsolete and the raceme thus appearing subumbellate. Flowers epigynous, resupinate, protandrous. Calyx synsepalous; tube adnate to the ovary, forming a hypanthium, obconic or obovoid, rarely ovoid, oblong, cylindrical, or depressed obovoid; lobes 5, valvate, persistent, dentiform, triangular, or oblong, rarely linear, distinct or rarely connate, much shorter to somewhat longer that the hypanthium, rarely as long as the corolla. Corolla zygomorphic, bilabiate or unilabiate, white or various shades of magenta, purple, or pink, rarely greenish or yellowish, sometimes longitudinally striped, glabrous or pubescent, rarely muricate; tube suberect, curved, arcuate, or sigmoid, dorsally cleft to about the middle; lobes 5, valvate, spreading, deflexed, or rarely erect. Stamens 5, syngenesious, included or exserted; filaments connate, free from the corolla or dorsally adnate for $\frac{1}{3}$–$\frac{1}{2}$ its length; anthers connate, dithecal, opening introrsely by longitudinal slits, the 3 dorsal ones a little longer than the 2 ventral ones, the latter or rarely all 5 with apical tufts of white hairs; pollen tricolporate, prolate, ellipsoidal. Ovary 2-loculed; placentae large, axile; style slen-

der, terete, with a ring of stiff white hairs near the apex; stigma 2-lobed, the lobes appressed and nonreceptive as the style grows through the anther tube, pushing out pollen, after which the stigmas spread and become receptive. Fruit a yellow, orange, or purple berry. Seeds numerous, small, dark brown to black, shiny, smooth or microscopically foveate-reticulate. Chromosome number $n = 14$ (Lammers, 1988).

Cyanea crispa (Gaudichaud) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Rollandia crispa* Gaudichaud, Voy. Uranie 459. 1829. *Lobelia crispa* (Gaudichaud) Endlicher, Ann. Wiener Mus. Naturgesch. 1: 170. 1836; not Graham, Edinburgh New Philos. J. 1: 173. 1826. *Cyanea rollandia* A. Gray, Proc. Amer. Acad. Arts 5: 149. 1861, nom. illeg. TYPE: "Iles Sandwich.," *Gaudichaud s.n.* (holotype, P).

Based on Gaudichaud's itinerary (St. John & Titcomb, 1983) and the known range of the species (Lammers, 1990), the holotype probably was collected on O'ahu, in the Ko'olau Mountains above Honolulu, during 26–29 August 1819.

Cyanea humboldtiana (Gaudichaud) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Rollandia humboldtiana* Gaudichaud, Voy. Bonite, Bot., pl. 76. 1842. TYPE: "Iles Sandwich.," Oct. 1836, *Gaudichaud s.n.* (lectotype, selected here, W).

Both Rock (1919) and St. John (1940) failed to locate type material of this species among Gaudichaud's specimens at P; Lammers likewise was unable to find any during a visit in September 1987. However, he did discover one sheet of original material at W, which is here designated as the lectotype. Based on Gaudichaud's itinerary (Lasègue, 1845) and the known range of the species (Lammers, 1990), the type probably was collected on O'ahu, in the Ko'olau Mountains above Honolulu.

Cyanea koolauensis Lammers, Givnish & Sytsma, nom. nov. Replaced name: *Rollandia angustifolia* (Hillebrand) Rock, Bull. Torrey Bot. Club 45: 136. 1918; not *Cyanea angustifolia* (Chamisso) Hillebrand, Fl. Hawaiian Isl. 253. 1888. Basionym of replaced name: *Rollandia longiflora* var. *angustifolia* Hillebrand, Fl. Hawaiian Isl. 246. 1888. TYPE: Hawaii. O'ahu: Pālolo Valley, *Hillebrand s.n.* (lectotype, selected here, BISH).

Only one other syntype, a sheet at GH labeled "Oahu from Manoa Eastward," has been seen by Lammers. A specimen at B cited by Rock (1918, 1919) could not be located; presumably, it was among those destroyed when the herbarium burned in 1943 (Hiepko, 1987).

Cyanea lanceolata (Gaudichaud) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Rollandia lanceolata* Gaudichaud, Voy. Uranie 458. 1829. *Lobelia lanceolata* (Gaudichaud) Hooker & Arnott, Bot. Beechey Voy. 88. 1832; not Hooker & Arnott, Bot. Beechey Voy. 301. 1838; nor Kuntze, Revis. Gen. Pl. 378. 1891. *Lobelia rollandia* Gaudichaud ex D. Dietrich, Syn. Pl. 1: 728. 1839, nom. illeg. *Delissea lanceolata* (Gaudichaud) A. Gray, Proc. Amer. Acad. Arts 5: 147. 1861. TYPE: "Iles Sandwich.," *Gaudichaud s.n.* (holotype, P; isotype, G).

Based on Gaudichaud's itinerary (St. John & Titcomb, 1983) and the known range of the species (Lammers, 1990), the type probably was collected on O'ahu, in the Ko'olau Mountains above Honolulu, during 26–29 August 1819.

Cyanea lanceolata subsp. **calycina** (Chamisso) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Lobelia calycina* Chamisso, Linnaea 8: 222. 1833. *Rollandia calycina* (Chamisso) G. Don, Gen. Hist. 3: 699. 1834. *Delissea calycina* (Chamisso) C. Presl, Prodr. Monogr. Lobel. 47. 1836. *Rollandia lanceolata* subsp. *calycina* (Chamisso) Lammers, Syst. Bot. 13: 507. 1988. TYPE: Hawaii. "O Wahu" [i.e., O'ahu]: *Chamisso s.n.* (holotype, LE).

Cyanea longiflora (Wawra) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Rollandia longiflora* Wawra, Flora 56: 44. 1873. TYPE: Hawaii. O'ahu: *leg.* Hillebrand, *Wawra 2285* (holotype, W).

Cyanea parvifolia (C. Forbes) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Rollandia parvifolia* C. Forbes, Occas. Pap. Bernice Pauahi Bishop Mus. 5: 10. 1911. TYPE: Hawaii. Kaua'i: Wai'oli Valley, 1 Aug. 1909, *Forbes 103.K* (holotype, BISH).

Cyanea purpurellifolia (Rock) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Rollandia purpurellifolia* Rock, Coll. Hawaii Publ. Bull. 2: 44. 1913. TYPE: Hawaii. O'ahu: Hau'ula ridge, Punalu'u Mts., 2,000 ft., Aug.

1911, *Rock 8824* (holotype, BISH; isotypes, BISH, GH, K, W).

Cyanea st.-johnii (Hosaka) Lammers, Givnish & Sytsma, comb. nov. Basionym: *Rollandia st.-johnii* Hosaka, Occas. Pap. Bernice Pauahi Bishop Mus. 11(13): 14. 1935. TYPE: Hawaii. O'ahu: Ko'olau Range, Waipi'o, Kīpapa Gulch, wet windswept main divide, 2,800 ft., 6 Aug. 1933, *Hosaka 1159* (holotype, BISH).

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New Series and Species of *Lepanthes* (Orchidaceae) from Ecuador

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ABSTRACT. Three new series in *Lepanthes* sect. *Lepanthes* are described, and sixteen new species of *Lepanthes* are described from Ecuador.

Prior to 1983, 30 species of *Lepanthes* Swartz had been attributed to Ecuador, mostly by Lindley, Reichenbach, and Schlechter from collections mostly by Jameson and Sodiro. Other better known collectors never bothered to collect a *Lepanthes*. Today, 295 species are known from Ecuador, but many of these have not yet been published. In order to handle this large number of basically similar species, series based on key-characters are employed. Some individuals of a few species fall between series. Therefore, a few species may be listed in more than one series.

The following 16 previously undescribed species are all members of section *Lepanthes*. Fourteen are in *Lepanthes* subsect. *Elongatae* (Luer, 1987) and two are in *Lepanthes* subsect. *Lepanthes*. Four series, two in each subsection, are recognized.

Lepanthes subsect. *Lepanthes* ser. *Lepanthes* is characterized by a congested inflorescence that remains shorter than the leaf. It contains by far the greatest number of species in the genus. *Lepanthes* subsect. *Lepanthes* ser. *Filamentosae* is characterized by a densely flowered inflorescence that is borne beyond the leaf by an elongated peduncle.

Lepanthes subsect. *Elongatae* ser. *Elongatae* is characterized by a "lax" or "loose" (distantly flowered) inflorescence that is longer, or becomes longer than the leaf. *Lepanthes* subsect. *Elongatae* ser. *Breves* is characterized by a loose inflorescence that remains shorter than the leaf. In the Pleurothallidinae a distantly flowered inflorescence is characterized by the exposed portion of the rachis between floral bracts being longer than the pedicels.

Lepanthes ser. **Lepanthes.** TYPE: *Epidendrum ovale* Swartz, Prodr. 125, 1788 = *Lepanthes ovalis* (Swartz) Fawcett & Rendle.

Lepanthes ser. **Filamentosae** Luer, series nov. TYPE: *Lepanthes filamentosa* Luer & Hirtz, Novon 3: ???, 1993.

Racemus congestus quam folio longiore.

Lepanthes ser. **Elongatae** Luer, series nov. TYPE: *Lepanthes elongata* Luer & Hirtz, Lindleyana 2: 99, 1987.

Racemus laxus quam folio longiore.

Lepanthes ser. **Breves** Luer, series nov. TYPE: *Lepanthes monoptera* Lindley, J. Bot. 1: 10, 1834.

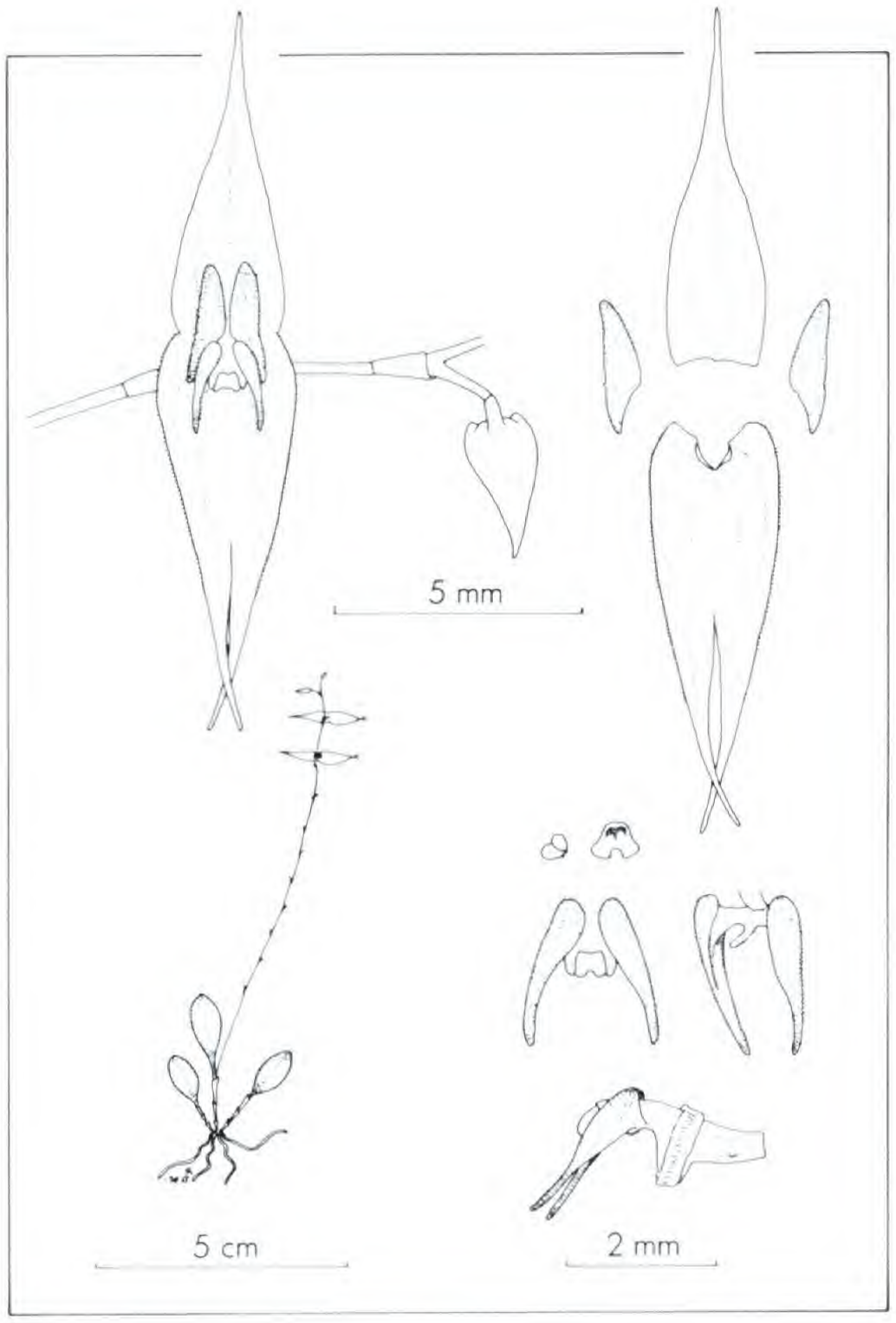
Racemus laxus quam folio breviore.

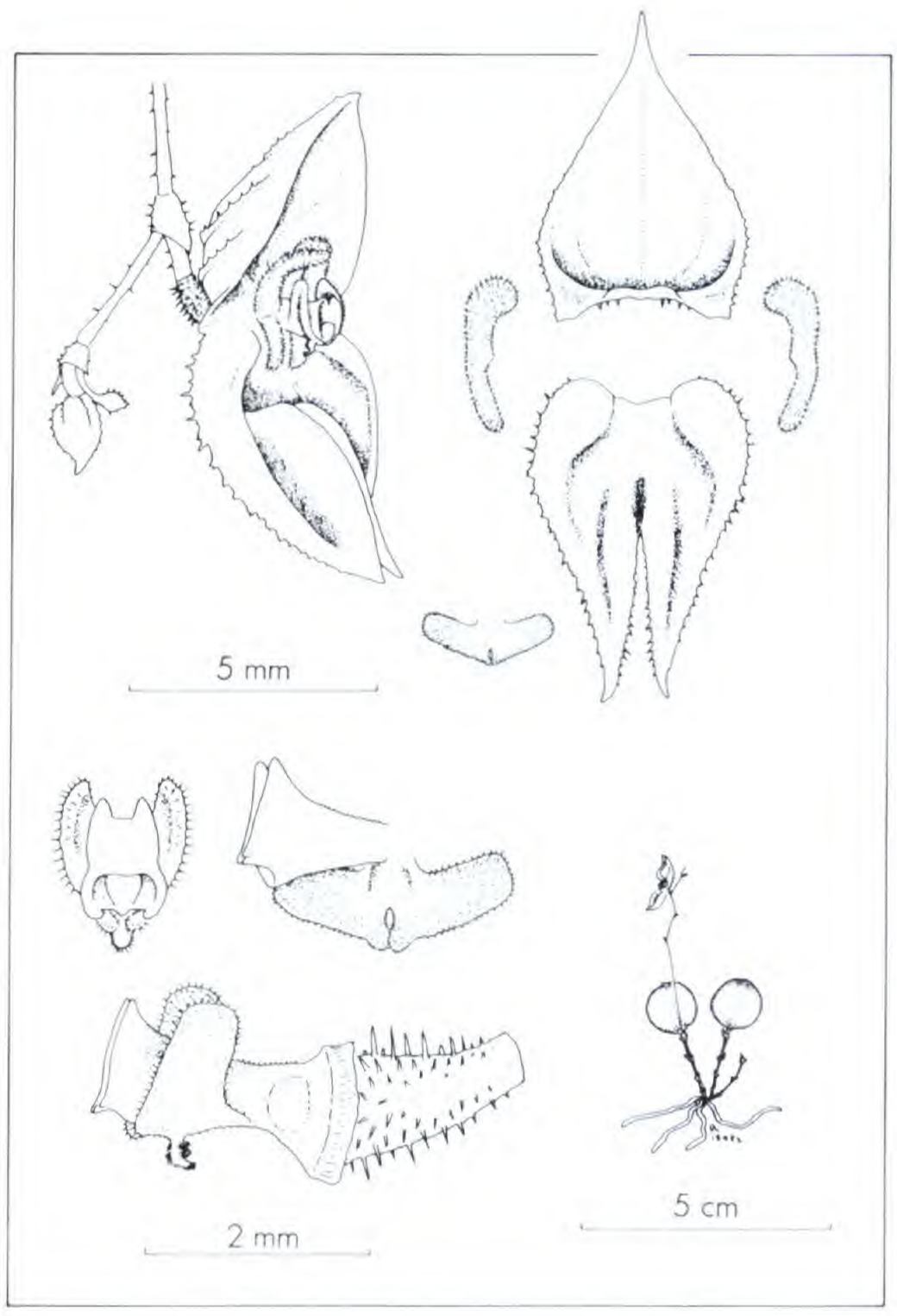
The vast majority of the species of *Lepanthes* from Ecuador that have come to my attention since 1978 have been discovered by Alexander C. Hirtz, a mining engineer in Quito, Ecuador. Not only does he have the enthusiasm to hunt them and an uncanny ability to find them, but he knows them by name, habitat, and locality, far better than I. He has also had the perseverance to photograph nearly every one. For these reasons I do not consider him merely the collector. I am pleased to include his name with mine in the following new descriptions.

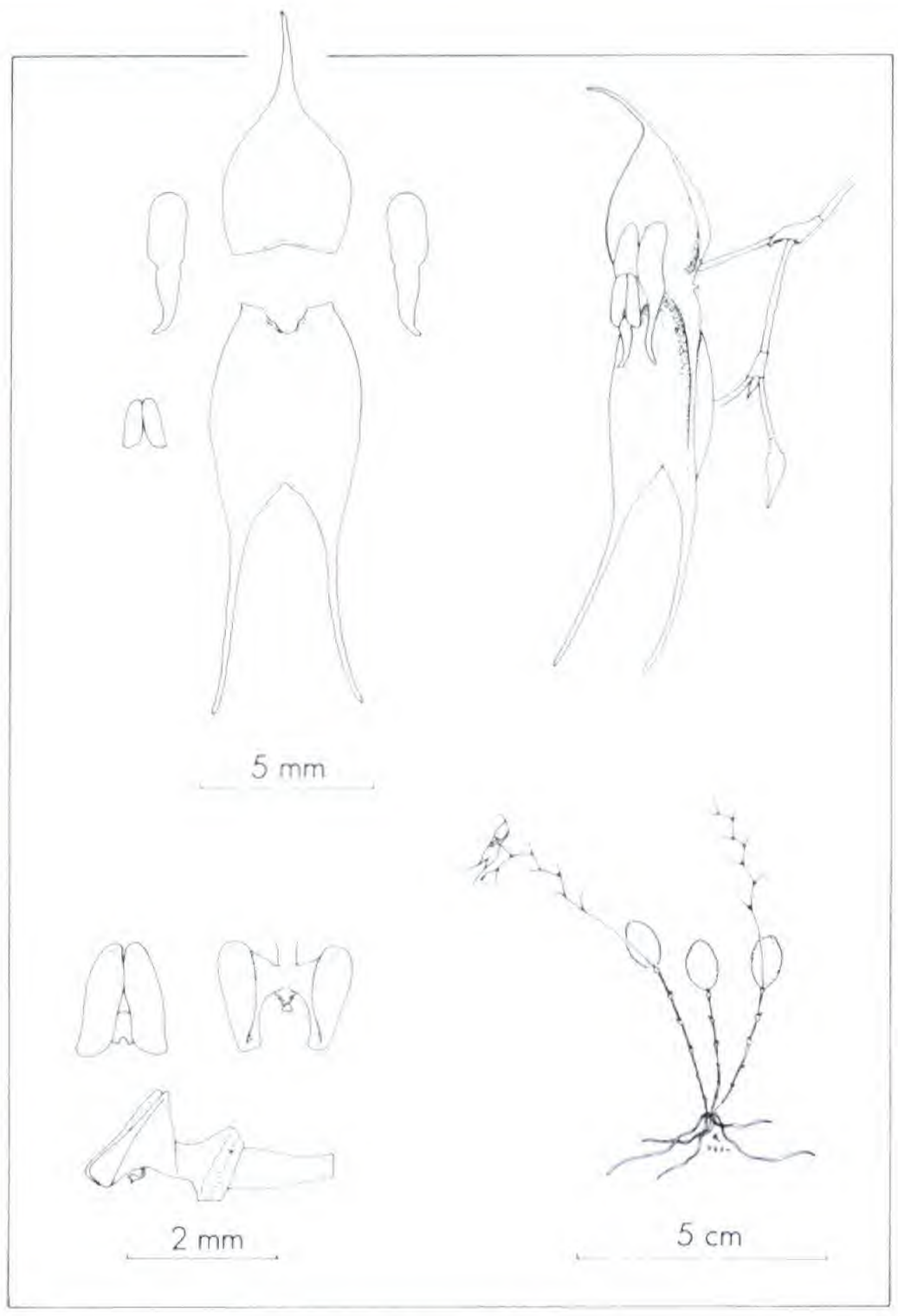
Lepanthes andreettae Luer, sp. nov. TYPE: Ecuador. Morona–Santiago: without locality, collected by A. Andreetta, probably in the vicinity E of Paute, ca. 1,800 m, flowered in cultivation at Paute by A. Andreetta, *C. Luer 13855* (holotype, MO). Figure 1.

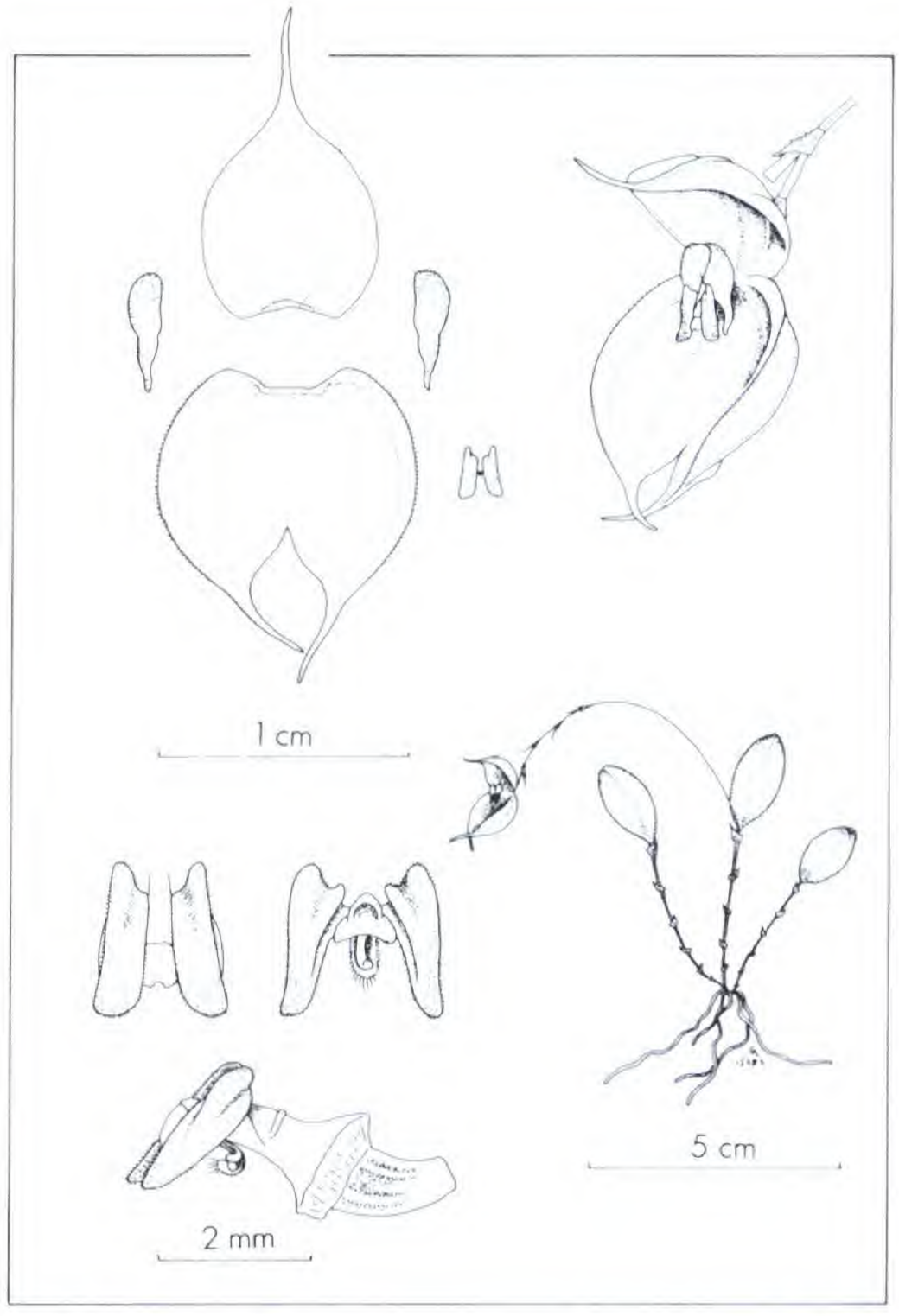
Planta parva; inflorescentia racemosa laxa folio elliptico multilongiore; floris sepalis purpureis late luteomarginatis, sepalo dorsali synsepaloque anguste ovatis acuminatis, synsepalo supra medium inciso, petalis transverse bilobis, lobis triangularibus, superiore ter majore, labelli laminis duabus anguste ovatis acuminatis, corpore angusto, appendice digitiformi pubescenti.

Plant small, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 5–8 mm long, enclosed by 2–3 loose, microscopically ciliate, lepanthiform sheaths. Leaf erect, coriaceous, elliptical, obtuse, 12–16 mm long, 6–8 mm wide, the base cuneate into a petiole 2–3 mm long. Inflorescence a loose, distichous, successively several-to many-flowered raceme up to 9 cm long, borne by a slender peduncle 15–20 mm long; floral bract 2 mm long; pedicel 1.5–2 mm long; ovary 1 mm long; sepals purple









Figures 1–4. —1 (Top left). *Lepanthes andreettae* Luer. —2 (Top right). *Lepanthes campodostele* Luer & Hirtz. —3 (Bottom left). *Lepanthes corkyae* Luer & Hirtz. —4 (Bottom right). *Lepanthes delhierroi* Luer & Hirtz.

with broad, yellow margins, the dorsal sepal narrowly ovate, acute, acuminate, 7 mm long, 2 mm wide, connate to the lateral sepals for 0.5 mm, the lateral sepals microscopically denticulate, narrowly ovate, acute, acuminate, oblique, 8 mm long, 3 mm wide together, connate 3 mm, the apices in apposition; petals pale rose, microscopically pubescent, transversely bilobed, 0.75 mm long, 2.6 mm wide, the lobes triangular, the upper lobe larger; lip pale rose, bilaminate, the laminae narrowly ovate, 2 mm long, the bases rounded, the apices acute, long-acuminate, microscopically pubescent, the connectives narrow, from the base of the blades, the body narrow, connate to the base of the column, the appendix pubescent, narrowly linear, incurved in the natural position and in contact with the stigma; column 1 mm long, the anther dorsal, the stigma ventral.

Etymology. Named in honor of Father Angel Andreetta, an Italian-born Salesian Padre at Paute, Ecuador, who discovered this species.

This species was collected by Father Andreetta, probably east of Paute, and cultivated by him at the mission near Paute. It is distinguished by the small habit and a successively flowered raceme much longer than the leaves. The flowers are comparatively large but narrow with acuminate sepals, the laterals in apposition. The blades of the lip are very narrowly ovate with the connectives arising at the base. The appendix is narrow and curved up to be intimately associated with the stigma.

Lepanthes campodostele Luer & Hirtz, sp. nov. TYPE: Ecuador. Zamora–Chinchipe: Cordillera del Condor, epiphytic in cloud forest E of Los Encuentros, 1,550 m, 18 May 1988, *C. Luer, A. Hirtz, W. Flores, A. Andreetta & W. Teague 13472* (holotype, MO). Figure 2.

Planta parva caespitosa; inflorescentia racemosa laxa foliis orbicularibus longiore; floris sepalis ovatis longiciliatis, petalis pubescentibus transverse lobatis oblongis, labello pubescenti bilobo, lobis oblongis erectis, appendice externa pubescenti, columna grandi cylindrica apice truncato bicornuto.

Plant very small, epiphytic, caespitose; roots comparatively fleshy. Ramicauls erect, slender, 12–15 mm long, enclosed by 4 long-ciliate, lepanthiform sheaths. Leaf erect, coriaceous, orbicular, 10 mm long, 10 mm wide, the rounded base contracted into a petiole 1.5 mm long. Inflorescence a loose, distichous, successively few-flowered raceme up to 30 mm long including the filiform peduncle 15 mm long, sparsely pubescent; floral bracts 1.5 mm long, spiculate; pedicels 1.5 mm long; ovary 1.5 mm long; sepals carinate-spiculate, the margins erose-ciliate, the dorsal sepal translucent, suffused with purple, ovate, deeply concave, acuminate, acute, 5 mm long, 4 mm wide unexpanded, connate to the lateral sepals for 1 mm, the lateral sepals purple, ovate, oblique acute, 6.5 mm long, 2.25 mm wide, connate 3.5 mm, deeply concave medial to the midveins, convex lateral to the midveins, convex along the medial margins in apposition; petals green pubescent, transversely bilobed, 0.5 mm long, 3 mm wide, the lobes subequal, oblong with rounded ends, the apex of the upper lobe incurved; lip green, ciliate, bilobed, the lobes oblong with rounded apices, 1 mm long, erect to either side of the column, the body cleft anteriorly, connate to the base of the column, the appendix external, oblong, recurved, pubescent; column comparatively large, cylindrical, 2 mm long, the apex truncate and flat with a pair of erect angles on the upper margin, the clinandrium on the lower half of the apical surface, separated from the subapical stigma by the rostellar flap along the lower margin.

Etymology. From the Greek *campodes*, "like a caterpillar," and *stele*, "the column," referring to the unusual shape of the column.

The flower of this species is large for the tiny plant with orbicular leaves. The sepals are carinate spiculate externally with ciliate-erose margins. The dorsal sepal is deeply concave, while the lateral sepals are concave centrally between convex margins. The convex medial margins are in apposition except basally, where the lateral sepals are connate and deeply concave. This unusual configuration is seen in the Bolivian *L. nycteris* Luer & Vásquez.

Most unusual is the comparatively large column. The oblong lobes of the lip are held erect to either side. The column is cylindrical with the apex flat. Two erect angles are present on the upper margin of the flat apical end. The clinandrium with the anther occupies most of the lower half of the end. The stigma is located along the lower margin. Although unrelated, the apex of the column is reminiscent of *Salpistele* Dressler.

Lepanthes corkyae Luer & Hirtz, sp. nov. TYPE: Ecuador. Carchi: epiphytic in cloud forest between Tulcán and Maldonado, 2,300 m, 2 Apr. 1984, *C. Luer, S. Dalström & T. Höijer 9934* (holotype, MO). Figure 3.

Species haec *Lepanthis schizicis* Luer similis, sed sepalis glabris, synsepalo concavo cum apicibus brevibus acutis differt.

Plant small, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 20–30 mm long, enclosed

by 5–6 close, minutely ciliate, lepanthiform sheaths. Leaf erect, coriaceous, elliptical, obtuse, 10–12 mm long, 5–8 mm wide, the base cuneate into a petiole 1 mm long. Inflorescence a loose, flexuous, successively several-flowered raceme up to 6 cm long, including the slender peduncle 1–2 cm long; floral bract 1 mm long; pedicel 2–3 mm long; ovary 1.5 mm long; sepals orange to red-brown, carinate, glabrous, the dorsal sepal ovate, obtuse, concave, 5 mm long, 3.5 mm wide unexpanded, the apex abruptly acuminate into a slender tail 2–3 mm long, the lateral sepals 11–12 mm long including the slender tails 5–6 mm long, the blades connate 4.5 mm into an oblong, bifid lamina 6 mm long, 4 mm wide, the free portions acute, contracted into non-approximate tails; petals yellow-orange to brown, transversely bilobed, 0.8 mm long, 4 mm wide, the upper lobe oblong with the apex rounded, the lower lobe narrowly triangular with the apex acute, lightly recurved; lip yellow-orange to brown, bilaminate, the blades oblong, lightly concave, glabrous, 1.5 mm long, with the apices subtruncate, the connectives cuneate, the body narrow, connate to the column above the base, the appendix small, triangular, concave, with an uncinate, apical segment; column 1 mm long, the anther dorsal, the stigma ventral.

Etymology. Named for Corky, Skeezix's sister, a character from Frank King's *Gasoline Alley.*

This species is very similar to *L. schizix*, and for years was considered to be the same. However, a recent collection and re-examination of pickled flowers reveal subtle differences. The sepals of *L. corkyae* are not ciliate; the synsepal is proportionately shorter and broadly concave with short, acute apices contracted into longer tails. *Lepanthes corkyae* occurs on the western slopes of northern Ecuador in the provinces of Carchi and Imbabura. *Lepanthes schizix* occurs on the western slopes of Pichincha.

Paratypes. ECUADOR. **Carchi:** cloud forest between Tulcán and Maldonado, 2,050 m, 2 Apr. 1984, *C. Luer, S. Dalström & T. Höijer 9919* (MO), 2,300 m, 17 Mar. 1991, *C. Luer, J. Luer, A. Hirtz, X. Hirtz & J. del Hierro 15147* (MO). **Imbabura:** Selva Alegre, 1,400 m, May 1989, *A. Hirtz & X. Hirtz 4250* (MO).

Lepanthes delhierroi Luer & Hirtz, sp. nov. TYPE: Ecuador. Napo: epiphytic in cloud forest between El Carmelo and La Bonita, 2,400 m, Aug. 1990, *A. Hirtz, X. Hirtz, J. del Hierro & F. Sarmiento 4965* (MO), C. Luer illustr. 15282. Figure 4.

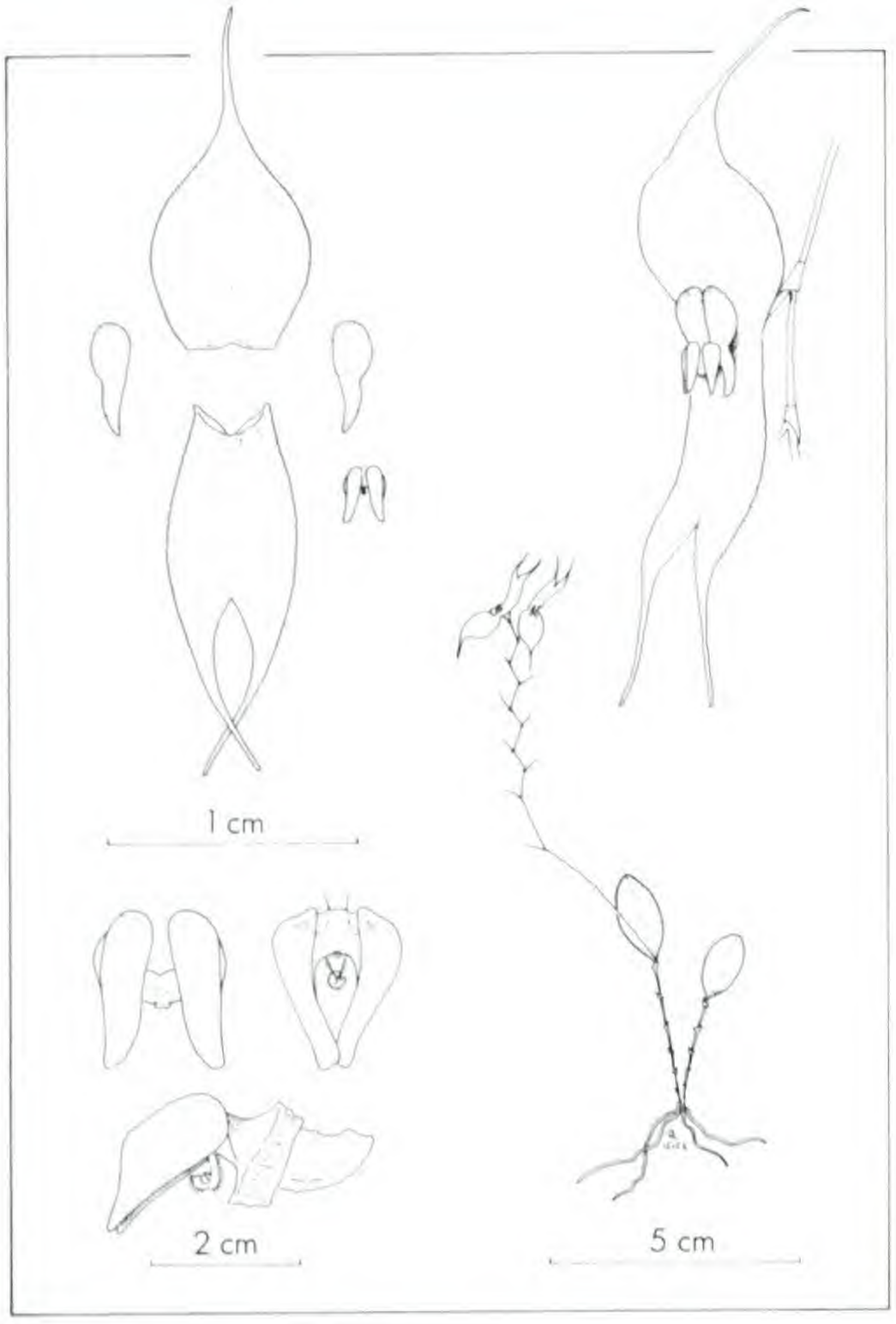
Planta parva caespitosa; racemo paucifloro foliis ellipticis crassis multilongiore; floris grandis sepalis late ovatis concavis obtusis acuminatis, petalis transverse bilobis, labelli laminis duabus oblongis longitudinaliter callosis, connectivis cuneatis, appendice cupulata processum stigmaticum amplectenti.

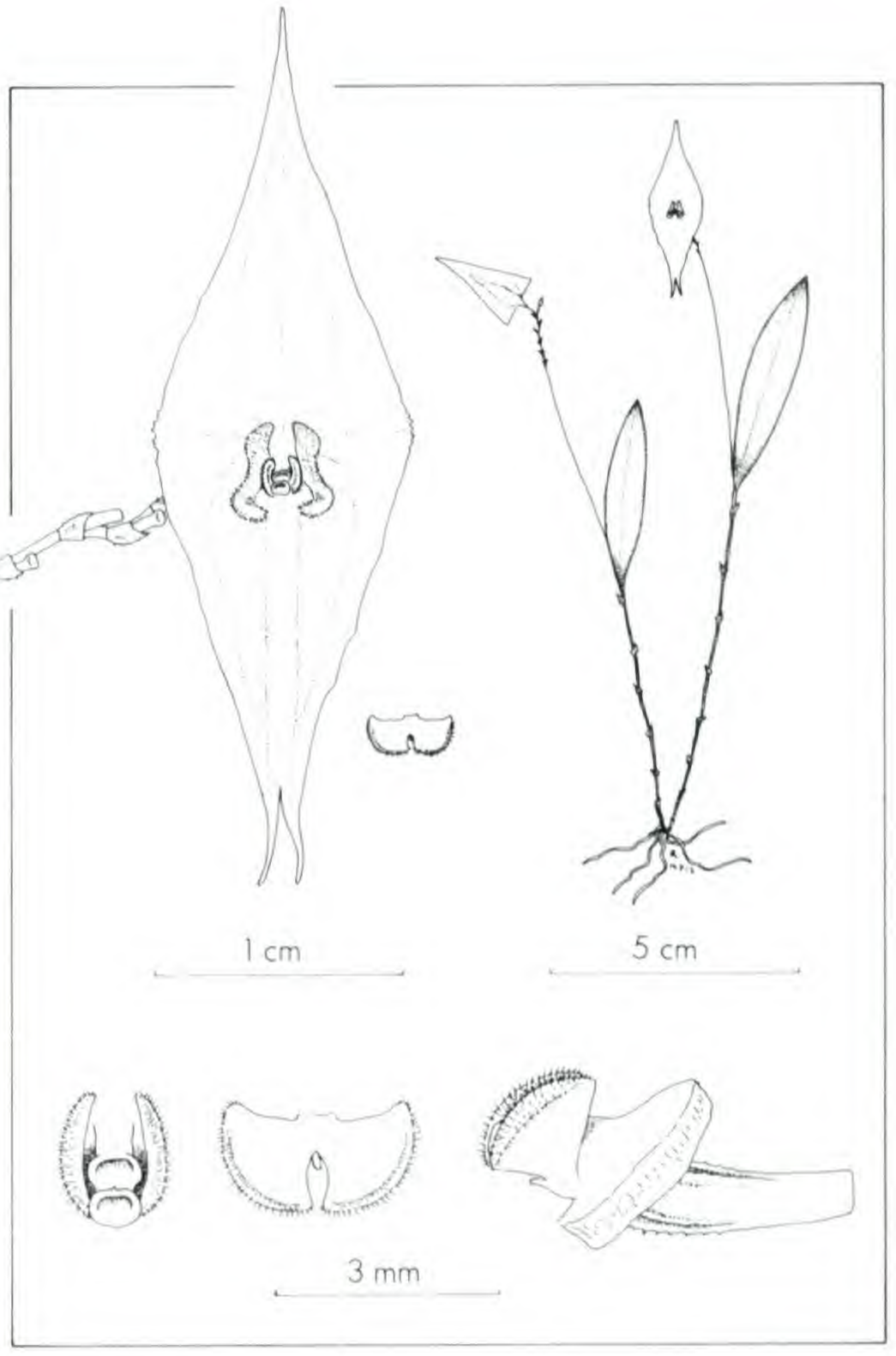
Plant small, epiphytic, caespitose, roots slender. Ramicauls slender, erect, 2–4 cm long, enclosed by 5–7 minutely ciliate-scabrous, lepanthiform sheaths. Leaf erect, thickly coriaceous, ± suffused with purple beneath, elliptical, subacute to obtuse, 17–28 mm long including a 2–4-mm-long petiole, 7–12 mm wide, the base cuneate into the petiole. Inflorescence a loose, flexible, successively few-to several-flowered raceme, up to 6 cm long including the slender peduncle 2–4 mm long; floral bract ciliate, 1.5–2 mm long; pedicel 2–3 mm long; ovary costate, 1–2 mm long; sepals red, sometimes with yellow stripes along the veins, glabrous, the dorsal sepal ovate, broadly ovate to suborbicular, concave, the blade 8–10 mm long, 5–8 mm wide, unexpanded, connate to the lateral sepals for 1 mm, the apex subacute to obtuse, acuminate into a slender tail 3–5 mm long, the lateral sepals connate 6 mm into an ovate to broadly ovate, bifid lamina, 10–11 mm long, 7–12 mm wide, with the subacute apices contracted into tails 2–4 mm long; petals red to orange-brown, minutely pubescent, transversely bilobed, 1 mm long, 4.5 mm wide, the upper lobe oblong, obtuse, the lower lobe smaller, narrowly triangular; lip red to orange-brown, bilaminate, the laminae oblong with obtuse ends, minutely pubescent, longitudinally callous below the middle, 2 mm long, the connectives short, cuneate, from near the base, the body connate to the base of the column, with a membranous, ciliate, slinglike appendix with a knoblike apex that holds an elongate process from the stigma; column terete, 1 mm long, the anther apical, the stigma ventral with a process grasped by the appendix.

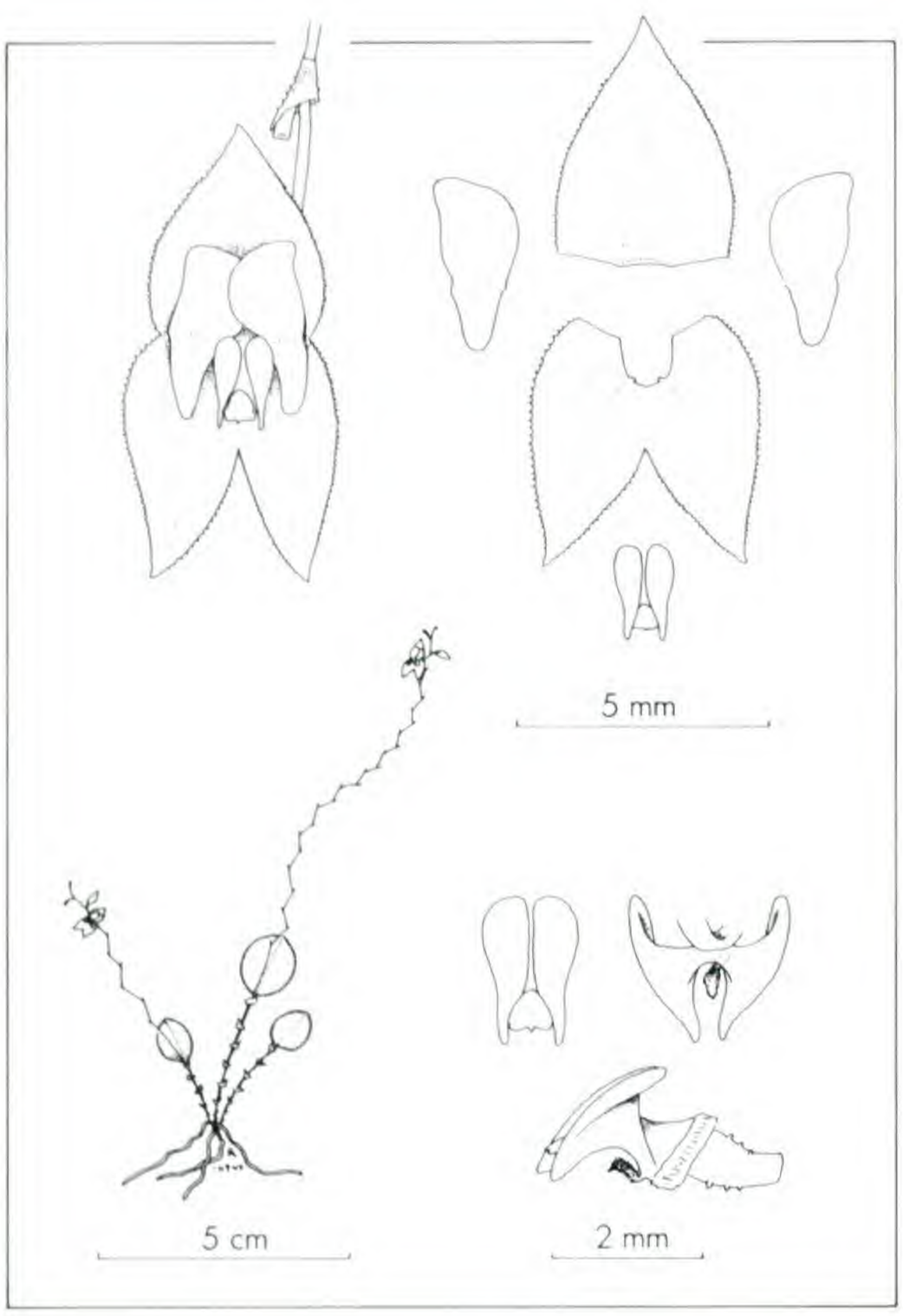
Etymology. Named in honor of Juan del Hierro of Quito, Ecuador, co-discoverer of this species.

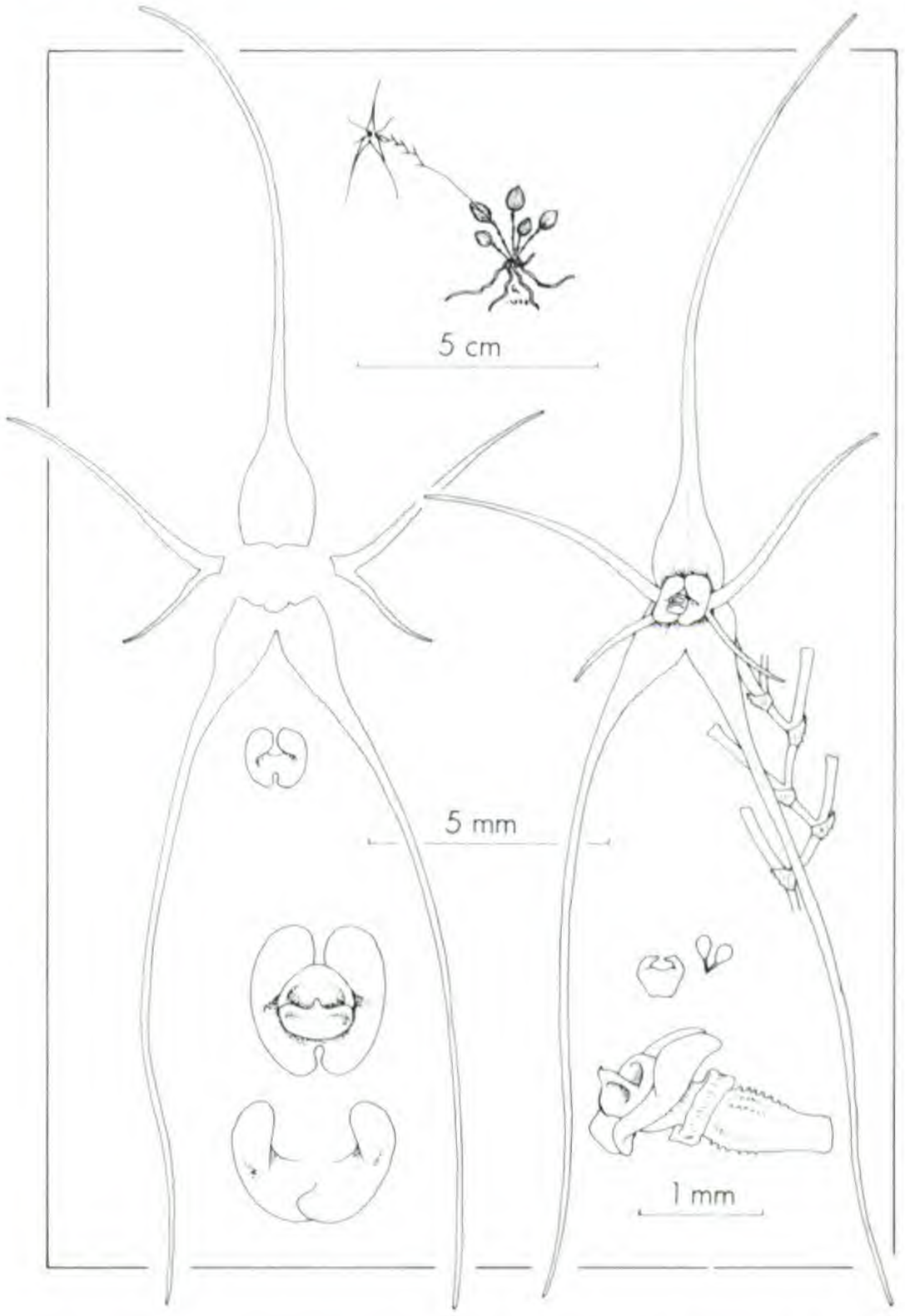
This showy species is distinguished by a loose, flexible, successively few-flowered raceme much longer than the elliptical leaf. The large, red flower with yellow veins is characterized by broad, concave sepals that are abruptly acuminate into short tails. The red, bilobed petals are not remarkable. The red blades of the lip are longitudinally callous toward the base. Most remarkable is the membranous, slinglike appendix with a knoblike apex that holds a long, curved process that descends from the stigma. A form with narrower sepals occurs farther south.

Paratypes. ECUADOR. **Morona–Santiago:** epiphytic in cloud forest, Valle del Paute, 2,200–2,400 m, collected by M. Portilla, flowered in cultivation by A. Andreetta at Paute, 16 May 1988, *C. Luer 13366* (MO).









Figures 5–8. —5 (Top left). *Lepanthes drymocharis* Luer & Hirtz. —6 (Top right). *Lepanthes echo* Luer & Hirtz. —7 (Bottom left). *Lepanthes exogena* Luer & Hirtz. —8 (Bottom right). *Lepanthes filamentosa* Luer & Hirtz.

Lepanthes drymocharis Luer & Hirtz, sp. nov. TYPE: Ecuador. Carchi: epiphytic in cloud forest E of Maldonado, 2,300 m, 17 Mar. 1991, *C. Luer, J. Luer, A. Hirtz, X. Hirtz & J. del Hierro 15152* (holotype, MO). Figure 5.

Species haec *Lepanthis schizicis* Luer similis, sed floribus duplomajoribus, sepali dorsalis vix concavi cauda recurva, synsepalo proportione breviore, et labelli laminis duabus lateribus deflexis differt.

Plant small, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 20–30 mm long, enclosed by 5–6 ciliate, lepanthiform sheaths. Leaf erect, coriaceous, elliptical, obtuse, 10–20 mm long, 6–9 mm wide, the base cuneate into a petiole 1 mm long. Inflorescence a loose, flexuous, successively several-flowered raceme up to 9 cm long, including the slender peduncle 2–3 cm long, 2 flowers often produced simultaneously; floral bract 1.5 mm long; pedicel 1.5 mm long; ovary 1 mm long; sepals red-brown, striped with yellow along the veins, carinate, minutely ciliate, the dorsal sepal broadly obovate, obtuse, 8–9 mm long, 6.5 mm wide, the apex acuminate into a slender, recurved tail 4–5 mm long, the lateral sepals 15 mm long including the slender tails 5–6 mm long, the blades connate 7 mm into an obovate, bifid lamina 5 mm wide, the free portions acute, tapered into nonapproximate tails; petals yellow, minutely pubescent, transversely bilobed, 1 mm long, 4.5 mm wide, the upper lobe oblong with the apex rounded, the lower lobe narrowly triangular; lip white, suffused with brown medially, bilaminate, the blades oblong, lightly concave on the upper surface, with deflexed sides, microscopically pubescent, 2 mm long, with the apices rounded, the connectives broad, short, the body broad, connate to the column at the base, the appendix pubescent, oblong, with an incurved, truncate apical segment; column 1 mm long, the anther dorsal, the stigma ventral.

Etymology. From the Greek *drymocharis*, "a woodland grace," referring to the beauty of the flowers.

This handsome species is related to *L. corkyae*, with which it is sympatric, and *L. schizix* from farther south. *Lepanthes drymocharis* is distinguished by the larger flowers with a broad, minimally concave dorsal sepal with a recurved tail. The sepals are minutely ciliate. The blades of the lip differ from those of the two related species in the broad, deflexed sides.

Lepanthes echo Luer & Hirtz, sp. nov. TYPE: Ecuador. Zamora–Chinchipe: epiphytic in forest near Nambija, 1,300 m, Feb. 1987, *A. Hirtz 3315* (holotype, MO), C. Luer illustr. 14712. Figure 6.

Planta mediocris, inflorescentia cum racemo grandiflo-ro subcongesto disticho cum pedunculo gracili folio anguste elliptico duplolongiore, sepalo dorsali synsepaloque triangularibus acutis leviter acuminatis, petalis transverse bilobis, lobo superiore ovato obliquo, lobo inferiore suboblongo incurvato apice incrassato, labello bilobo, lobis flabellatis marginis incrassatis, appendice parva pubescenti.

Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 3–7 cm long, enclosed by 4–7 ciliate, lepanthiform sheaths. Leaf erect, coriaceous, narrowly elliptical, acute, 2.5–4.5 cm long, 0.8–1 cm wide, the base cuneate into a petiole 2–4 mm long. Inflorescence a subcongested, distichous, successively few-flowered raceme up to 10 mm long, borne beyond the leaf by a slender peduncle 4–5 cm long; floral bract 1.5–2 mm long, lightly muriculate; pedicel 1.5–2 mm long; ovary 2.5 mm long; sepals glabrous, the dorsal sepal triangular, acute, lightly acuminate, 17 mm long, 11 mm wide, connate to the lateral sepals for 4 mm, the lateral sepals connate 12 mm into a triangular synsepal 18 mm long, 11 mm wide, the apices in apposition, acute, lightly acuminate, free for 4 mm; petals minutely pubescent, transversely bilobed, 1 mm long, 4 mm wide, the upper lobe ovate, oblique, acute, the lower lobe suboblong, incurved near the middle with the incurved apical portion thickened, the lower lobe thrice longer than the upper lobe; lip red, bilobed, pubescent, the lobes flabellate with rounded, thickened margins as rudimentary blades, 1.9 mm long, 3.6 mm wide expanded, the lobes (connectives) cuneate to form the narrow body, connate to the base of the column, the appendix small, oblong, pubescent; column 1.5 mm long, the anther dorsal, the stigma apical.

Etymology. Named for the mythological nymph Echo. The large, gaping flower is reminiscent of *L. dalessandroi* Luer.

This species is known only from the type collection by Alexander Hirtz. It is similar to *L. dalessandroi*, known from nearby localities, but it is easily distinguished by the short, more or less congested, instead of loose, raceme (subsect. *Lepanthes*) borne by a peduncle beyond the leaf (ser. *Elongatae*). The flower is large, with the triangular, noncaudate dorsal sepal and synsepal spreading widely in opposite directions. The incurved, apical portion of the lower lobe of the petal is thickened. The blades of the lip consist merely of the thickened margins of fan-shaped lobes of the lip.

Lepanthes exogena Luer & Hirtz, sp. nov. TYPE: Ecuador. Zamora–Chinchipe: epiphytic in cloud forest S of Yangana above Valladolid, 2,450 m, 23 Mar. 1985, *C. Luer, J. Luer, A. Hirtz & W. Flores 10944* (holotype, MO). Figure 7.

Planta parva; inflorescentia laxe multiflora folio late ovato multilongiore; floris sepalis acutis minute denticulatis, petalis transverse bilobis, lobo superiore oblongo quam lobo inferiore obtuse triangulari majore, labelli laminis duabus anguste ovatis, connectivis brevibus cuneatis, corpore angusto, appendice stipitata pubescenti ex pagina externa corporis orienti.

Plant small, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 10–30 mm long, enclosed by 5–8 ciliate, lepanthiform sheaths with dilated ostia. Leaf erect, coriaceous, broadly ovate to orbicular, 7–13 mm long, 7–12 mm wide, the apex subacute, obtuse to rounded, the base broadly cuneate into a petiole 1.5–2 mm long. Inflorescence a loose, flexuous, successively several-flowered raceme up to 12 cm long, including the slender peduncle 1.5 cm long; floral bract 1.25–2 mm long; pedicel 1 mm long; ovary 1 mm long; sepals dark red with narrow, green margins, carinate, minutely denticulate, the dorsal sepal ovate, acute, 4–5 mm long, 2.5–3.25 mm wide, connate to the lateral sepals for 0.5 mm, the lateral sepals ovate, acute, oblique, 4–5 mm long, 1.5–2 mm wide, connate 1 mm; petals orange, microscopically pubescent to glabrous, transversely bilobed, 0.5–1 mm long, 3–3.5 mm wide, the upper lobe oblong, oblique, the apex obtuse, the lower lobe smaller, triangular, with the apex rounded; lip white or yellow, suffused with red medially, bilaminate, the blades ovate, microscopically pubescent to glabrous, 2 mm long, with the apices acute and bases rounded, the connectives short, cuneate, the body narrow, connate to the column at the base, the appendix ovoid, pubescent, stipitate, originating from the external surface of the body at the attachment to the column; column 2 mm long, the anther dorsal, the stigma ventral.

Etymology. From the Latin *exogenus*, "formed on the outside," referring to the position of the appendix.

This little species is distinguished by the flexuous raceme that becomes much longer than the broadly ovate to orbicular leaves. The red sepals with thin, green margins are acute and minutely denticulate. The petals are bilobed and broad. The blades of the lip are narrowly ovate with short connectives that form a narrow body. The stipitate appendix originates from the external surface.

Paratypes. ECUADOR. **Zamora–Chinchipe:** cloud forest S of Yangana above Valladolid, *C. Luer, J. Luer, A. Hirtz & W. Flores 10852* (MO).

Lepanthes filamentosa Luer & Hirtz, sp. nov. TYPE: Ecuador. Esmeraldas: epiphytic in cloud forest W of Lita, 750 m, 18 Jan. 1987, *C. Luer, J. Luer, C. H. Dodson, A. Hirtz, D. Benzing & D. Bermudes 12378* (holotype, MO). Figure 8.

Planta minutissima caespitosa; inflorescentia racemosa subdensa folio elliptico microscopice ciliato longiore; floris sepalis ovatis apice longissime filamentosis, petalis bifurcatis apicibus filamentosis, labello bilobo, lobis auriculatis superne laminas indistinctas formantibus, inferne apicibus incurvatis, appendice nulla.

Plant minute, epiphytic, caespitose; roots comparatively thick. Ramicauls erect, slender, 4–10 mm long, enclosed by 3–5 microscopically ciliate, lepanthiform sheaths. Leaf erect, coriaceous, elliptical, 3–7 mm long, 2.5–5 mm wide, the apex obtuse to subacute, prominently apiculate, the margins microscopically cellular-ciliate, the base cuneate into a petiole up to 1 mm long. Inflorescence a subdense, distichous, successively several-flowered raceme up to 7 mm long, borne by a filiform peduncle 10–18 mm long; floral bracts 1–1.5 mm long, muriculate; pedicels 1.5–2.5 mm long; ovary 1 mm long, with the ribs cellular-papular; sepals yellow to white suffused with purple centrally, carinate, ovate, with the acute apices extremely long-attenuate, the dorsal sepal 10–17 mm long, 1.25–1.5 mm wide, connate to the lateral sepals for 0.5 mm, the lateral sepals oblique, 10–16 mm long, 1–1.25 mm wide, connate 0.5 mm; petals yellow, bifurcate 1 mm above the base, the divisions filiform, 3–5.5 mm long; lip yellow, glabrous, bilobed, the lobes auricular, 1.25 mm long, with the half above the column thickened to form an ill-defined lamina, the half below the middle falcate with broadly rounded, incurved, overlapping apices, without an appendix, the body connate to the base of the column; column 1 mm long, the anther and the stigma apical.

Etymology. From the Latin *filamentosus*, "filamentous," referring to the long-acuminate sepals and lobes of the petals.

Mature plants of this species are some of the smallest known in the genus. The flowers are also minute, but the lengths of the exceedingly long, filamentous tails of the sepals and the filamentous lobes of the petals create dimensions comparable to flowers of much larger species.

Lepanthes filamentosa grows relatively frequently in the wet, lowland forest of northwestern Ecuador where it is nevertheless difficult to find. It grows buried in thick layers of moss on small branches of trees. Sometimes only the minute, spiderlike flowers are visible at a distance of 2 or 3 cm from the hidden plant. Although the racemes are congested (subsect.

Lepanthes), they are borne far beyond the leaves by hairlike peduncles (ser. *Elongatae*).

Paratypes. ECUADOR. **Esmeraldas:** cloud forest W of Lita, color forms, *C. Luer et al. 12377, 12408* (MO).

Lepanthes grossiradix Luer & Hirtz, sp. nov. TYPE: Ecuador. El Oro: epiphytic in forest remnant W of Pacha, 2,250 m, 23 May 1988, *C. Luer, A. Hirtz, W. Flores, A. Andreetta & W. Teague 13613* (holotype, MO). Figure 9.

Planta mediocris caespitosa; radicibus crassissimis; inflorescentia racemosa laxe multiflora foliis ellipticis multilongiore; floris sepalis ovatis acutis sparse ciliatis, petalis transverse lobatis, lobo superiore oblongo, lobo inferiore triangulari, labelli laminis duabus pubescentibus lunatis, connectivis late cuneatis, corpore lato, appendice minuta fissa.

Plant medium in size, epiphytic, caespitose; roots purple, coarse, thick. Ramicauls erect, slender, 3–6 cm long, enclosed by 6–8 ciliate, lepanthiform sheaths dilated at the ostia. Leaf erect, coriaceous, elliptical-ovate, acute, slightly acuminate, 2.5–4 cm long, 0.9–1.2 cm wide, the base cuneate into a petiole 2–4 mm long. Inflorescence a loose, distichous, successively many-flowered raceme up to 6 cm long including the slender peduncle ca. 1 cm long; floral bracts 1.5 mm long; pedicels 1.5 mm long; ovary 0.5 mm long; sepals brown with yellow margins, sparsely ciliate, the dorsal sepal ovate, concave, acute, 3 mm long, 2 mm wide expanded, connate to the lateral sepals for 0.5 mm, the lateral sepals ovate, oblique, acute, 3 mm long, 1.2 mm wide, 1-veined, connate 1 mm; petals brown, minutely pubescent, transversely bilobed, 0.5 mm long, 1.9 mm wide, the upper lobe oblong, obtuse, the lower lobe triangular; lip brown, minutely pubescent, bilaminate, the laminae lunate with indistinct blades, 1.5 mm long, the connectives broadly cuneate, the body broad, connate to the base of the column, the appendix minute, oblong, cleft down the middle; column terete, 1.5 mm long, the anther dorsal, the stigma apical.

Etymology. From the Latin *grossiradix*, "a thick root," referring to the thick, coarse, purplish roots.

Most remarkable of this species are the roots that are extremely thick for the size of the plant. The racemes are loosely flowered, beginning much shorter than the leaf, but eventually lengthening to about twice the length of the leaf. The sepals are acute and sparsely ciliate, the laterals with only one vein. The lobes of the lip are lunate, surrounding the apex of the column with a dorsal anther and apical stigma. The appendix is a minute, oblong structure with a cleft down the center.

Lepanthes illinizae Luer & Hirtz, sp. nov. TYPE: Ecuador. Pichincha: epiphytic in wet forest, W flank of Volcán Illiniza, Cerro Azul, 2,900 m, 23 Jan. 1987, *C. Luer, J. Luer & A. Hirtz 12478* (holotype, MO). Figure 10.

Species haec *L. bilobae* Lindley affinis, sed sepalis denticulatis et petalorum lobis apice rotundatis differt.

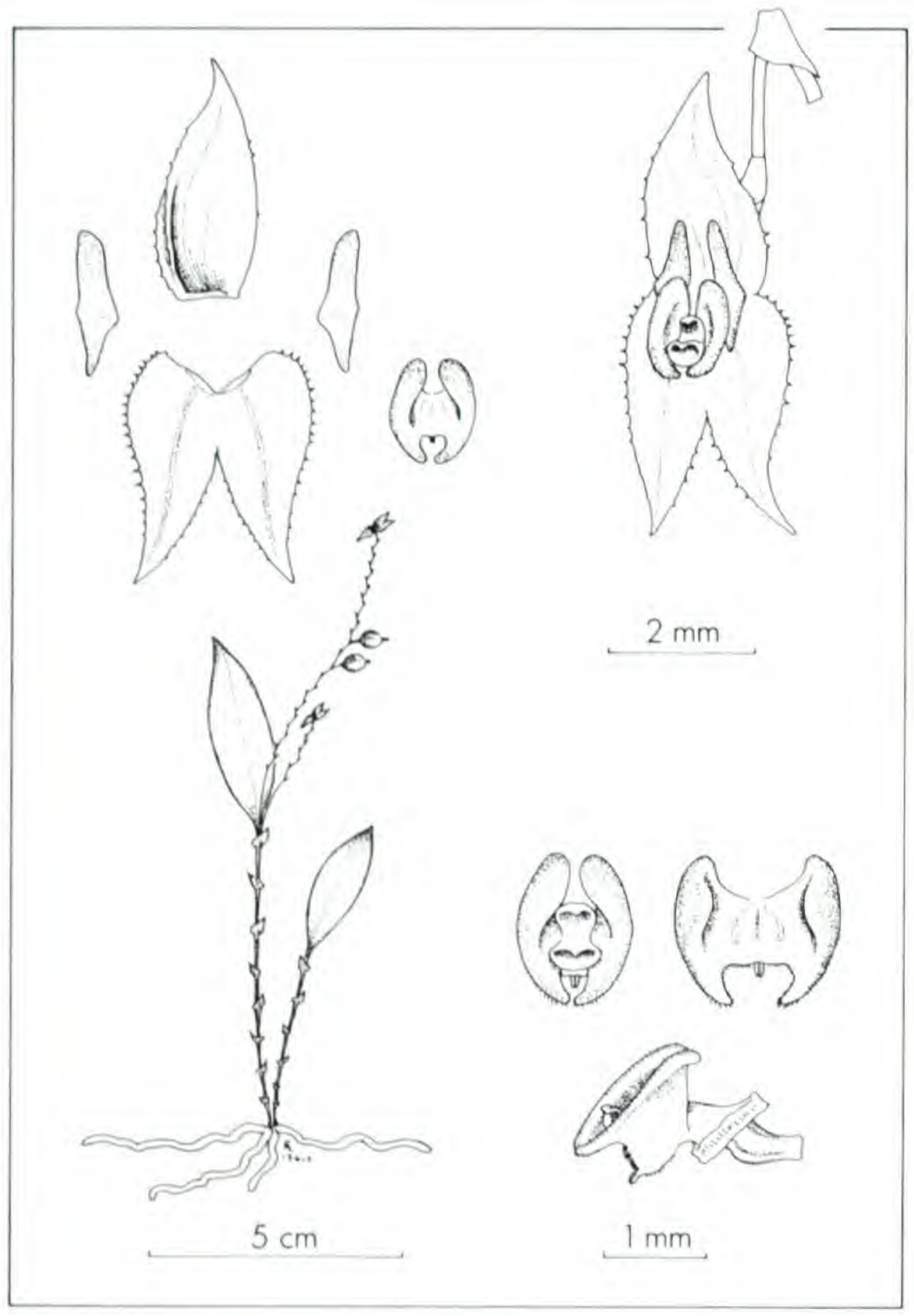
Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls erect, stout, 5–12.5 cm long, enclosed by 10–14 dark, loose, ciliate, lepanthiform sheaths. Leaf erect, coriaceous, elliptical-ovate, acute, acuminate, 4–6.5 cm long, 1.5–2 cm wide, the base cuneate to rounded, contracted into a petiole ca. 4 mm long. Inflorescence an elongating, loose, distichous, lightly flexuous, successively many-flowered raceme up to 14 cm long including the pedicel 1.5–2.5 cm long; floral bracts 3 mm long, pedicels 1.5 mm long; ovary 2 mm long; flowers yellow to orange-brown; sepals ovate, acute, lightly acuminate, carinate, denticulate, the dorsal sepal 7 mm long, 3.5 mm wide, connate to the lateral sepals for 1 mm, the lateral sepals oblique, 7 mm long, 2.25 mm wide, connate 2.5 mm; petals microscopically pubescent, transversely bilobed, 1 mm long, 3 mm wide, the upper lobe oblong with the end rounded, the lower lobe triangular with the end rounded, shorter than the upper lobe; lip microscopically pubescent, bilaminate, the blades narrowly oblong with rounded ends, 2.25 mm long, the connectives cuneate, the body narrow, connate to the base of the column, the appendix small, ovoid, pubescent; column 2 mm long, the anther dorsal, the stigma ventral.

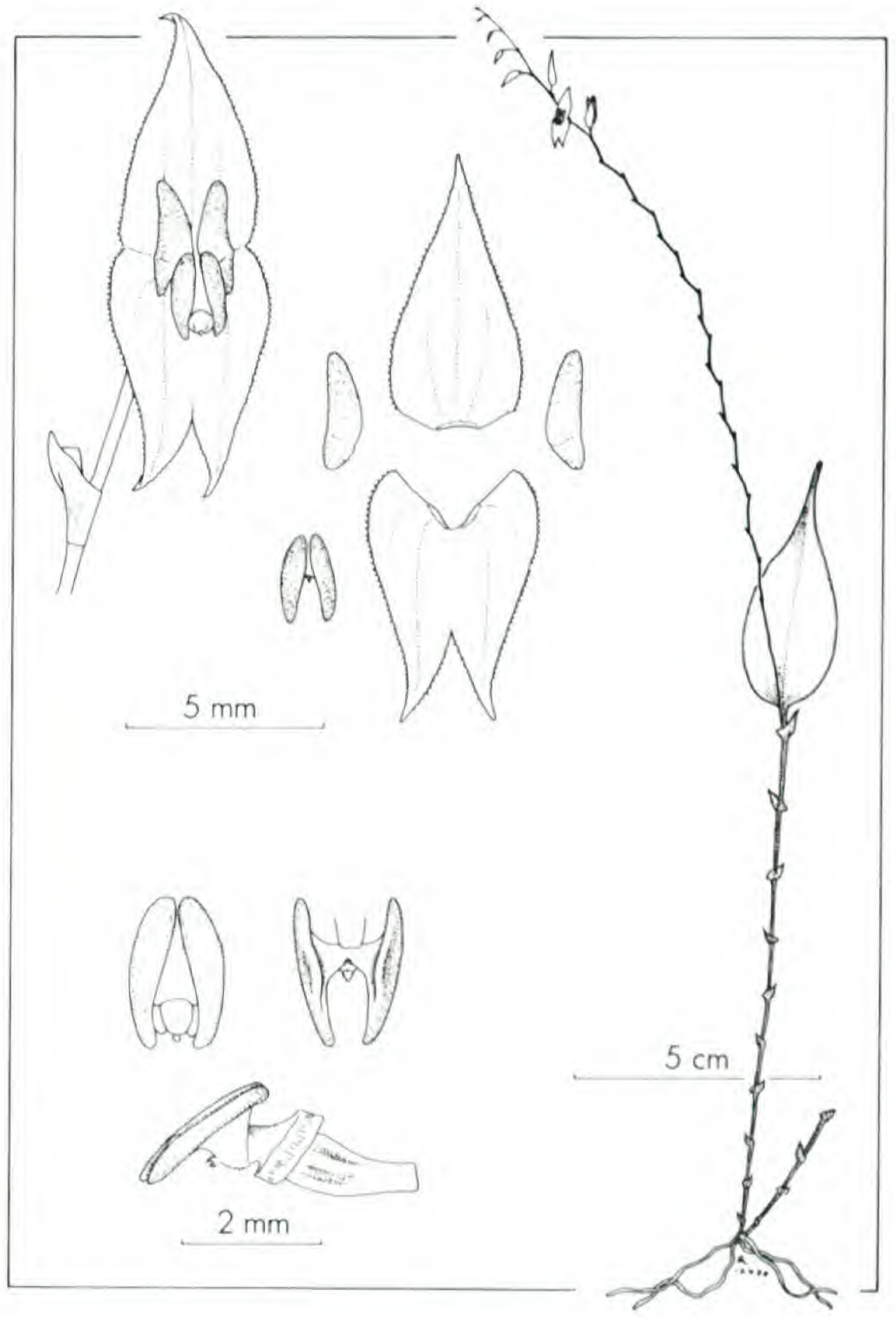
Etymology. Named for Volcán Illiniza, on which this species was discovered.

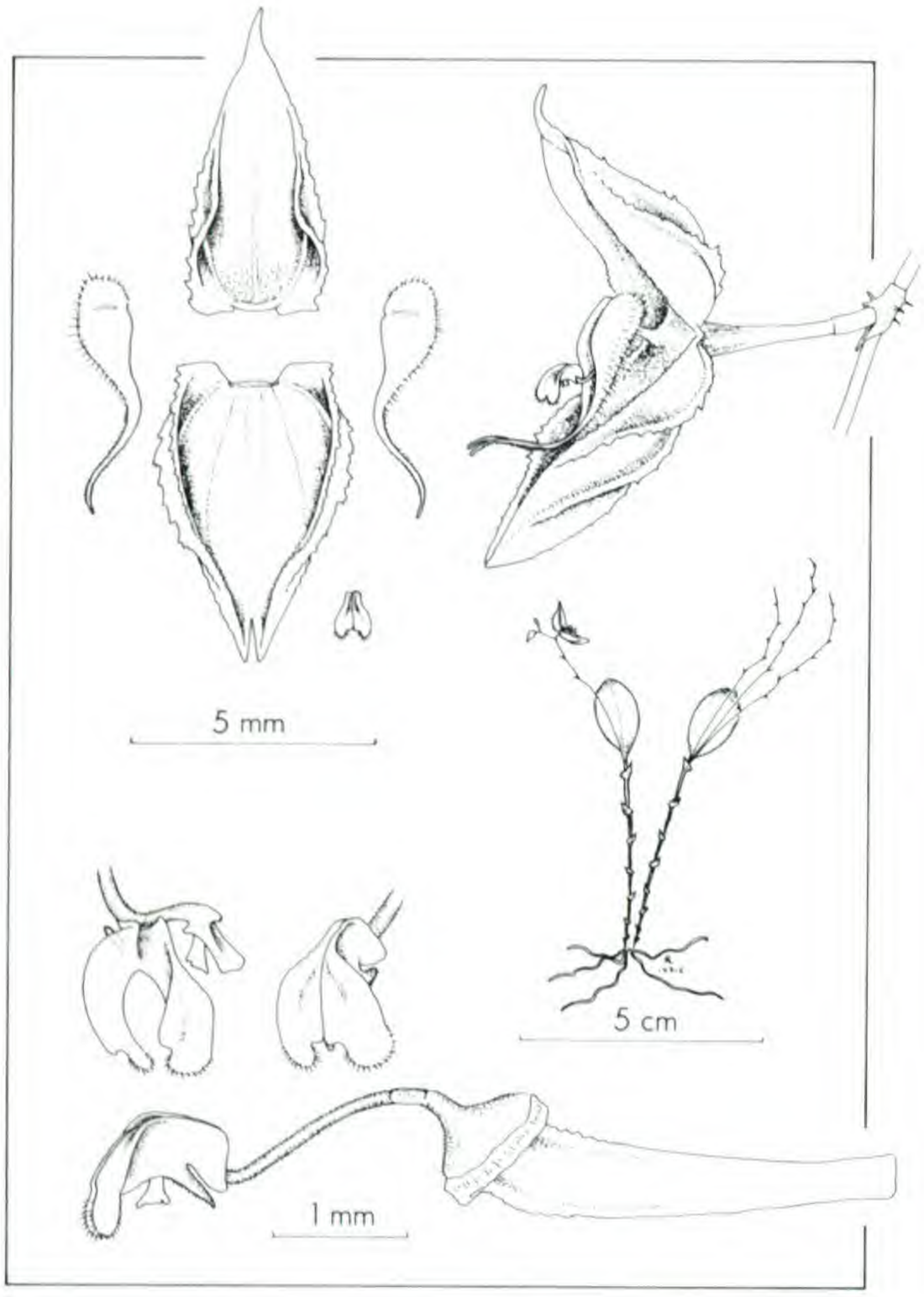
This species is another in the hoard belonging to the *L. biloba* and *L. elongata* complexes. The loosely flowered racemes begin flowering shorter than the leaves, but eventually attain lengths exceeding the leaves several times. *Lepanthes illinizae* is distinguished from the species included in the above complexes by the following combination of features: peduncles shorter than the leaves; sepals acute and lightly acuminate, glabrous but denticulate; lobes of the petals rounded; blades of the lip narrowly oblong, and the appendix small and ovoid.

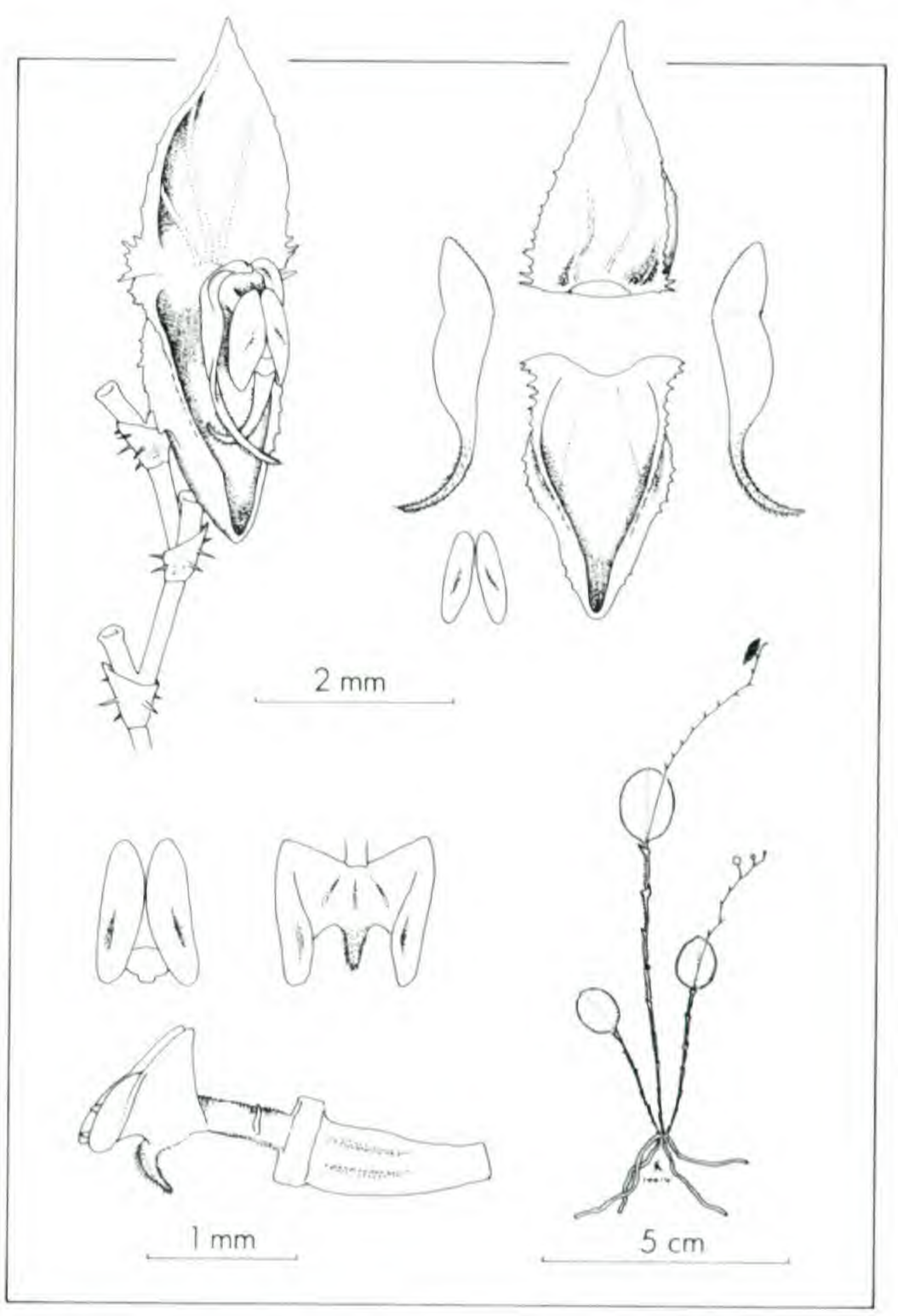
Lepanthes nematostele Luer, sp. nov. TYPE: Ecuador. Carchi: epiphytic in wet, mossy forest E of Maldonado, 1,900 m, 15 Feb. 1989, *S. Dalström & T. Höijer 1234* (holotype, MO), C. Luer illustr. 14715. Figure 11.

Planta parva; racemo laxo successive plurifloro folio elliptico ter longiore; floris sepalo dorsali synsepaloque









Figures 9–12. —9 (Top left). *Lepanthes grossiradix* Luer & Hirtz. —10 (Top right). *Lepanthes illinizae* Luer & Hirtz. —11 (Bottom left). *Lepanthes nematostele* Luer & Hirtz. —12 (Bottom right). *Lepanthes phrixothrix* Luer & Hirtz.

cristatis concavis ovoideis, petalis transverse bilobis, lobo inferiore longissime acuminato hirsuto, labelli minuti connectivis corporeque ad columnam circa apicem adnatis, laminis duabus arcuatis inter se agglutinatis apice rotundatis ciliatis, appendice triangulari retrorsa, columna longissima gracillima.

Plant small, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 3–5 cm long, enclosed by 7–8 long-ciliate, lepanthiform sheaths. Leaf erect, coriaceous, elliptical, subacute, 10–15 mm long excluding the petiole 1–1.5 mm long, 8–10 mm wide, the base cuneate into the petiole. Inflorescence an erect, loose, successively several-flowered raceme up to 5 cm long including the slender peduncle 2–2.5 cm long; floral bract 1.5 mm long; pedicel 1.5–2 mm long; ovary 3.5 mm long, lightly ribbed; sepals dark red, concave, crested along the veins and margins, the dorsal sepal ovoid, acute, 6 mm long, 2.5 mm wide unexpanded, connate to the lateral sepals for 1 mm, the lateral sepals connate 5 mm into an ovoid synsepal similar to the dorsal sepal, 6 mm long, 4 mm wide unexpanded, the apices free for less than 1 mm; petals transversely bilobed, long-pubescent on the back surface, 1 mm long, 5 mm wide, the upper lobe short, semicircular, the lower lobe triangular, acute, long-acuminate; lip bilaminate, the laminae glabrous, arcuate, firmly agglutinated to each other below the middle over the column, 1.25 mm long, the apices everted, rounded, ciliate, the connectives and body short, adnate to the column near the apex, the appendix triangular, retrorse; column weak, proportionately very long and very slender, 3.5 mm long, the anther dorsal, the stigma ventral with a prominent, descending process.

Etymology. From the Greek *nematostele*, "a threadlike column," referring to the column.

This remarkable species is characterized by the small vegetative habit with long-ciliate, lepanthiform sheaths; a loose inflorescence longer than the leaves; concave, crested sepals; petals with a long-acuminate lower lobe and arising from the shaft of the column; and a long, slender column bearing near the tip a tiny lip. The blades of the lip are adherent over the column. A prominent stigmatic process as large as the retrorse appendix descends from between the blades.

Lepanthes phrixothrix Luer & Hirtz, sp. nov. TYPE: Ecuador. Morona–Santiago: Cordillera del Condor, epiphytic in forest E of Guismé, 1,650 m, 20 Jan. 1989, *C. Luer, J. Luer, P. Jesup & A. Jesup 14014* (holotype, MO). Figure 12.

Planta parva; ramicaulium vaginis longipubescentibus; racemo laxo folio suborbiculato multilongiore; floris sepalis cristatis, synsepalo cymbiformi, petalis transverse bilobis, lobo superiore triangulari, lobo inferiore majore longicaudato, labelli laminis duabus oblongis, corpore latissimo ad columnae gracilis medium adnato, appendice triangulari pubescenti.

Plant small, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 1.5–6 cm long, enclosed by 5–8 densely and coarsely long-ciliate, lepanthiform sheaths. Leaf erect, coriaceous, suborbicular, obtuse to rounded, 7–15 mm long, 7–11 mm wide, the rounded base contracted into a 1-mm-long petiole. Inflorescence an arching, loose, successively many-flowered raceme, up to 5 cm long including the slender peduncle 10–15 mm long; floral bract 0.5 mm long; pedicel 0.75 mm long; ovary 1 mm long, lightly ribbed; sepals costate-crested, the dorsal sepal red, triangular, acute, concave, 3 mm long, 1.5 mm wide, connate to the lateral sepals for 1 mm, the lateral sepals completely connate into an ovoid, boat-shaped synsepal, 3 mm long, 1.5 mm wide unexpanded, the apex narrowly obtuse; petals yellow, minutely pubescent, transversely bilobed, 0.5 mm long, 3 mm wide, the upper lobe triangular, the lower lobe oblong, the acute apex attenuate into an equally long, slender tail, the lower lobe much longer than the upper lobe; lip red, bilaminate, the laminae glabrous, oblong, 1 mm long, the apices rounded, the connectives broad, quadrate, forming a broad body, adnate to the middle of the slender column, the appendix triangular, protuberant and decurved, pubescent; column 1.5 mm long, the anther apical, the stigma ventral.

Etymology. From the Greek *phrixothrix*, "with bristling hair," referring to the lepanthiform sheaths.

This little species is known only from the Cordillera del Condor. It is characterized by the small vegetative habit with long-ciliate, lepanthiform sheaths; a loose, successively flowered raceme eventually reaching much longer than the small, round leaf; the costate-crested sepals, the laterals connate into a boat-shaped synsepal; the petals with the lower lobes long-tailed; the glabrous oblong blades of the lip with a pubescent, protruding, triangular appendix. Although the inflorescence is "loose" by definition, it approaches being "dense."

Paratypes. ECUADOR. **Morona–Santiago:** E of Chuchumbletza, 1,650 m, 21 May 1988, *C. Luer, A. Hirtz, W. Flores, W. Teague & A. Andreetta 13539* (MO).

Lepanthes sigsigensis Luer & Hirtz, sp. nov. TYPE: Ecuador. Morona–Santiago: epiphytic in cloud forest E of the pass E of Sigsig, 2,700 m, 15 May 1988, *C. Luer, A. Hirtz, W. Flores, A. Andreetta & W. Teague 13350* (MO). Figure 13.

Planta mediocris caespitosa; inflorescentia racemosa laxissima disticha foliis ovatis multilongiore; floris sepalis ovatis acutis minute denticulatis, petalis transverse lobatis, lobis oblongis obtusis, lobo superiore longiore, labelli laminis duabus glabris anguste ovatis, connectivis cuneatis, appendice gracili sigmoidea minute pubescenti.

Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 3–7.5 cm long, enclosed by 7–10 ciliate, lepanthiform sheaths dilated at the ostia. Leaf erect, coriaceous, ovate, acute, slightly acuminate, 3–4 cm long, 1.3–1.7 cm wide, the rounded base contracted into a petiole 2–3 mm long. Inflorescence a loose, distichous, successively several-flowered raceme up to 10 cm long including the slender peduncle 2–2.5 cm long; floral bracts 2.5–3 mm long, crested; pedicels 3.5–4.5 mm long; ovary alate, 1 mm long; sepals light yellow, minutely denticulate, the dorsal sepal with a broad, central, purple stripe, triangular-ovate, acute, 8 mm long, 4 mm wide, connate to the lateral sepals for 1.5 mm, the lateral sepals ovate, oblique, acute, 8 mm long, 3 mm wide, connate 2 mm; petals orange, suffused with purple medially, microscopically cellular-glandular, transversely bilobed, 1.25 mm long, 5.5 mm wide, the lobes oblong, obtuse, the upper lobe longer; lip red-orange, essentially glabrous, bilaminate, the laminae narrowly ovate, with the apex narrowly rounded, 3 mm long, the connectives shortly cuneate, the body narrow, connate to the base of the column, the appendix slender, sigmoid, minutely pubescent; column terete, 2 mm long, the anther dorsal, the stigma ventral.

Etymology. Named for the town of Sigsig, near the area where this species was discovered.

Although superficially similar to other medium-sized species with relatively large flowers borne in a long, loose raceme (e.g., *L. capitanea* Reichenbach f. and *L. effusa* Schlechter), this species is distinguished by the ovate leaves, minutely denticulate sepals, simple petals and blades of the lip, but with a slender, sigmoid appendix borne in the sinus.

Lepanthes splendida Luer & Hirtz, sp. nov. TYPE: Ecuador. Morona–Santiago: epiphytic in wet forest along the new road W of Macas toward Guamote, 1,900 m, 16 Jan. 1989, *C. Luer, J. Luer, P. Jesup, A. Jesup, A. Hirtz & S. Ortega 13937* (holotype, MO). Figure 14.

Planta parva; racemo laxo simul florenti folio elliptico ter longiore; floris purpurei grandis sepalo dorsali triangulari acuminato, synsepalo ovato breviter bifurcato multimajore, petalis transverse bilobis, lobis ovoideis, lobo inferiore multiminore, labelli laminis duabus anguste falcatis acutissimis, connectivis brevibus, appendice bipartita.

Plant small, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 10–15 mm long, enclosed by 3–4 minutely ciliate, lepanthiform sheaths. Leaf erect, coriaceous, elliptical, subacute, 17–22 mm long excluding the petiole 2 mm long, 6–8 mm wide, the base cuneate into the petiole. Inflorescence an erect, loose, simultaneously flowered raceme of 5–6 large, red-purple flowers, up to 9.5 cm long including the slender peduncle 3 cm long; floral bract 2 mm long; pedicel 3–4 mm long; ovary 1 mm long, lightly ribbed; sepals red-purple, glabrous, the dorsal sepal triangular, acute, acuminate, 9.5 mm long, 3.5 mm wide, connate to the lateral sepals for 1 mm, the lateral sepals connate 8 mm into a broad lamina 13 mm long, 7 mm wide, the apices free for 3 mm, subacute, shortly apiculate; petals yellow-white, microscopically cellular pubescent, transversely bilobed, 1 mm long, 2.25 mm wide, the upper lobe ovoid, obtuse, the lower lobe triangular, obtuse, much smaller than the upper lobe; lip rose, bilaminate, the laminae glabrous, subfalcate, 1.25 mm long, the bases rounded, the apices narrowly acuminate, the connectives short, forming a narrow body with a two-parted appendix beneath the column; column 1.5 mm long, the anther apical, the stigma ventral.

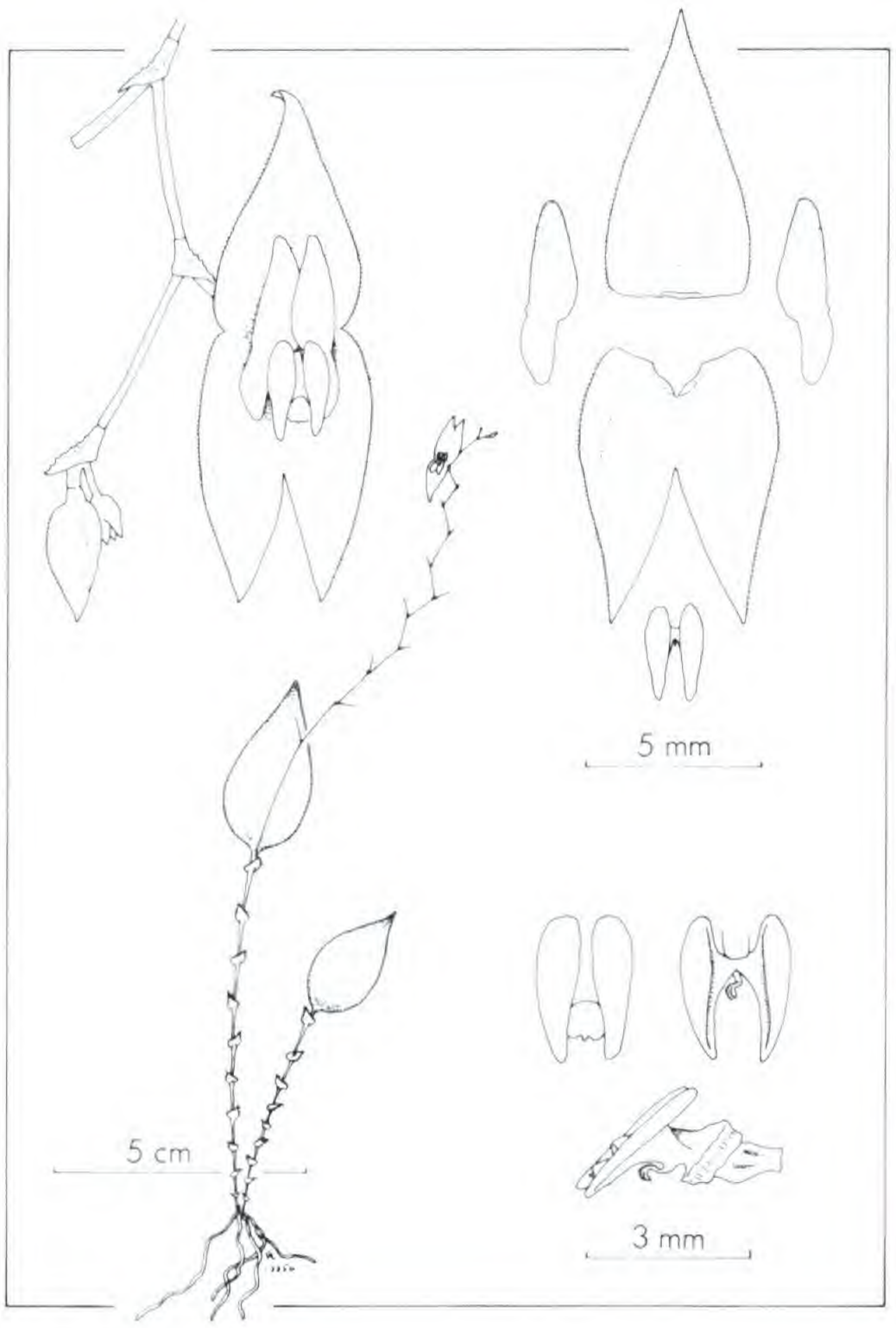
Etymology. From the Latin *splendidus*, "splendid, elegant," referring to the beauty of the species.

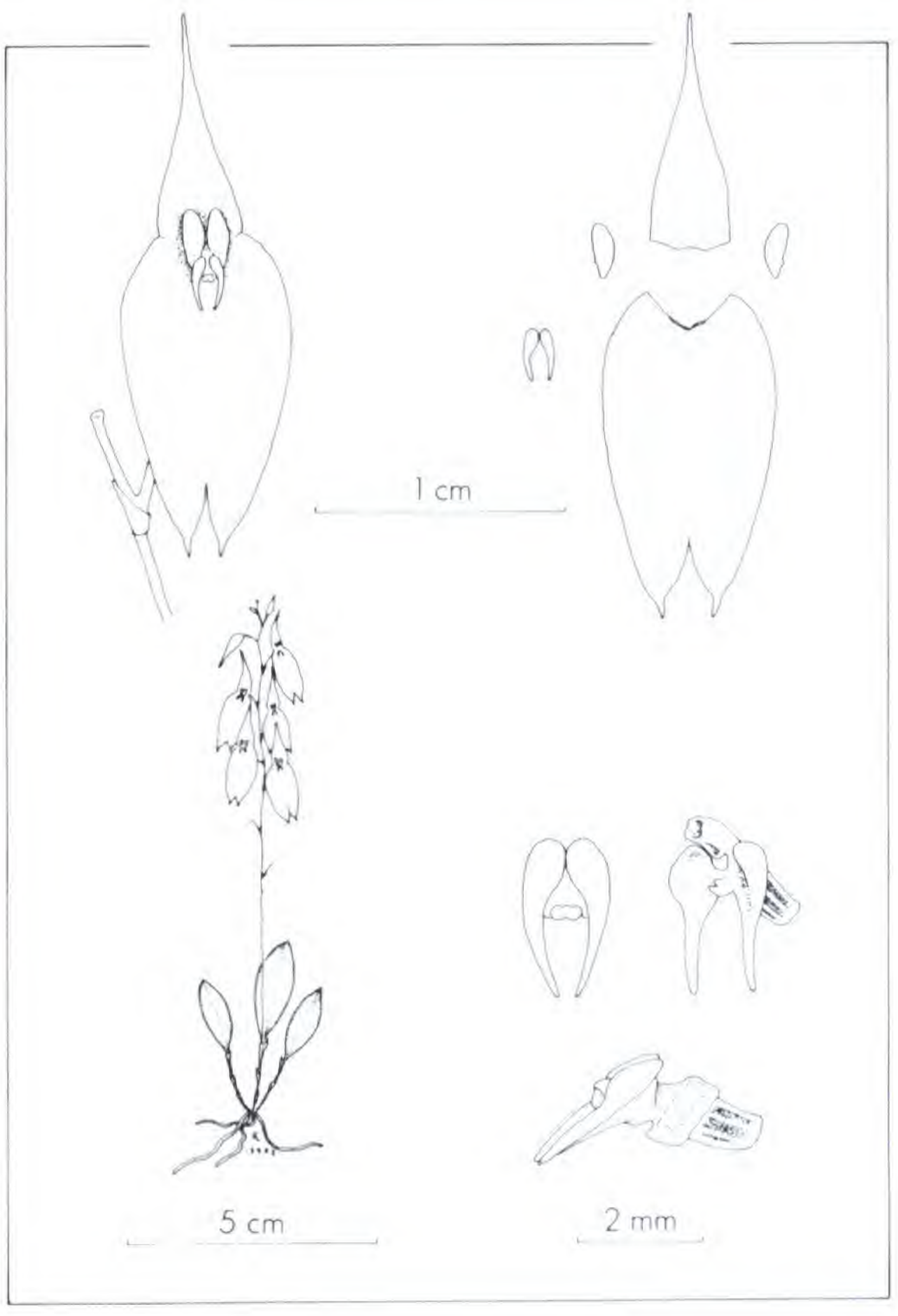
This remarkable species is characterized by the small vegetative habit and an imposing, erect inflorescence of several large, simultaneous, purple flowers. Unfortunately, the only plant found failed to survive. It was discovered by Santiago Ortega in the forest along the road under construction between Macas and Guamote.

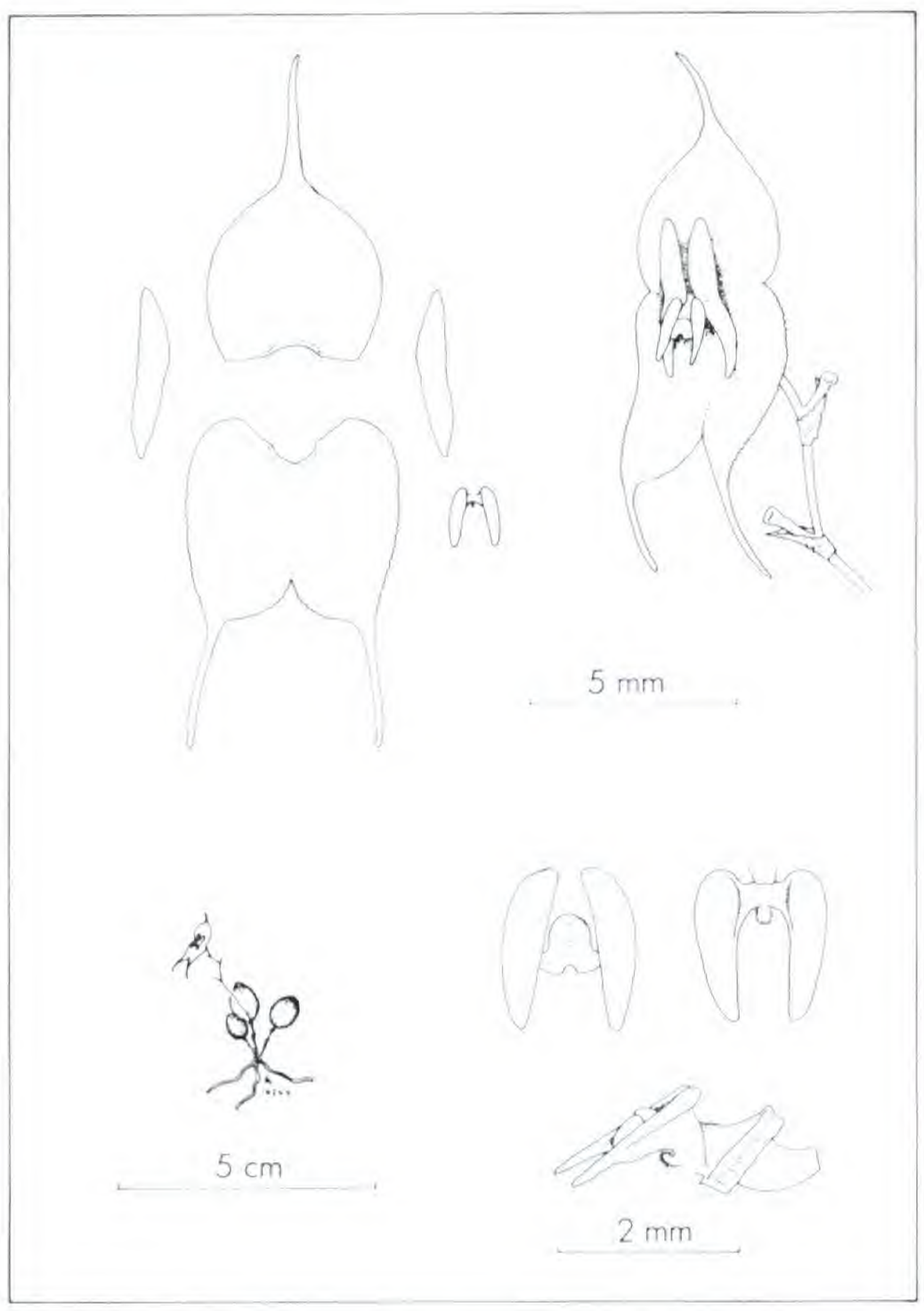
The broad synsepal is considerably larger than the acute dorsal sepal. The lower lobe of the petals is minute. The blades of the lip are falcate, and the short, two-parted appendix is held between the blades beneath the column.

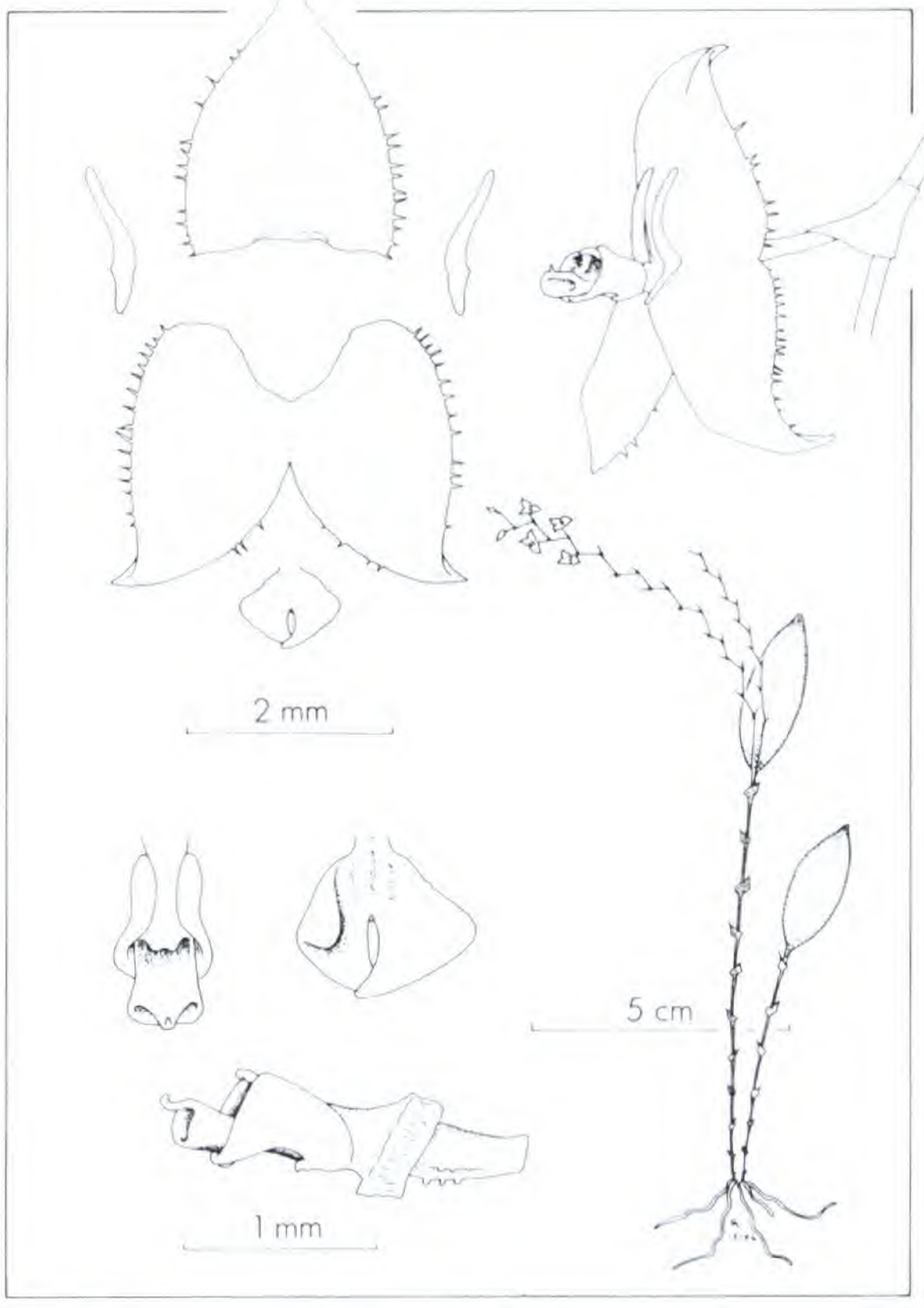
Lepanthes synema Luer & Hirtz, sp. nov. TYPE: Ecuador. Zamora–Chinchipe: epiphytic in elfin forest E of the pass E of Loja, 2,750 m, 21 Mar. 1985, *C. Luer, J. Luer, A. Hirtz & W. Flores 10724* (holotype, MO). Figure 15.

Planta parvula; racemo laxo folio suborbiculato multilongiore; floris sepalis obtusis abrupte caudatis, petalis transverse bilobis, labelli laminis duabus planis oblongis, corpore angusto appendice oblonga pubescenti munito.









Figures 13–16. —13 (Top left). *Lepanthes sigsigensis* Luer & Hirtz. —14 (Top right). *Lepanthes splendida* Luer & Hirtz. —15 (Bottom left). *Lepanthes synema* Luer & Hirtz. —16 (Bottom right). *Lepanthes vaginans* Luer & Hirtz.

Plant very small, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 2–7 mm long, enclosed by 2–4 minutely ciliate, lepanthiform sheaths. Leaf erect, coriaceous, suborbicular, obtuse to rounded, 6–8 mm long, 4.5–6 mm wide, the rounded base contracted into a 1-mm-long petiole. Inflorescence a loose, successively few-flowered raceme, up to 2 cm long including the slender peduncle 8–10 mm long; floral bract 1.5 mm long; pedicel 1.5 mm long; ovary 0.5 mm long; sepals yellow, subcarinate, the dorsal sepal suffused with red centrally, suborbicular, 4.5 mm long, 4.5 mm wide, with the rounded apex abruptly contracted into a slender tail 2.5 mm long, connate to the lateral sepals for 1 mm, the lateral sepals oblong, oblique, connate 3 mm into an oblong, bifid lamina, 5 mm long, 5 mm wide together, the apices obtuse, contracted into slender tails 3 mm long; petals yellow, cellular-glandular, transversely bilobed, 0.75 mm long, 4 mm wide, the lobes subequal, oblong, narrowly obtuse; lip yellow, bilaminate, the laminae glabrous, oblong, 1.8 mm long, the apices rounded, the connectives cuneate, forming a narrow body, connate to the base of the column, the appendix small, oblong, incurved, pubescent; column 1 mm long, the anther apical, the stigma ventral.

Etymology. From the Greek *synaimos*, "a kinsman," referring to the similarity to some other small species.

This tiny twig-epiphyte of subparamo, elfin forests is closely related to several other minute, sympatric species, e.g., *L. caudata* Luer & Escobar, *L. floresii* Luer & Hirtz, *L. jimburae* Luer & Hirtz, *L. paradoxa* Luer & Hirtz, and *L. vermicularis*. From all of them *L. synema* is distinguished by the smaller habit; round, abruptly caudate sepals; and flat, oblong blades of the lip with a small, oblong appendix.

Lepanthes vaginans Luer & Hirtz, sp. nov. TYPE: Ecuador. Carchi: epiphytic in cloud forest E of Maldonado, 2,300 m, 17 Mar. 1991, *C. Luer, J. Luer, A. Hirtz, X. Hirtz & J. del Hierro 15156* (holotype, MO). Figure 16.

Planta mediocris; racemo laxo flexuoso folio elliptico breviore ad multilongiore; floris sepalis late ovatis ciliatis, lateralibus uninervibus, petalis minutis angustis, labello bilobo, lobis obcuneatis deflexis columnam vaginantibus.

Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 5–8 cm long, enclosed by 8–11 microscopically scabrous, lepanthiform sheaths with dilated ostia. Leaf erect, coriaceous, elliptical, narrowly obtuse, 3–3.5 cm long, 1–1.3 mm wide, the base cuneate into a petiole ca. 3 mm long. Inflorescence a loose, flexuous, successively several-to many-flowered raceme up to 9 cm long, including the slender peduncle ca. 1 cm long, 2–4 flowers often produced simultaneously; floral bracts 1.25 mm long; pedicel 2–2.5 mm long; ovary 0.75 mm long; sepals yellow, suffused with rose medially, carinate, coarsely ciliate, broadly ovate, subacute, lightly acuminate, the dorsal sepal 2–2.5 mm long, 2 mm wide, 3-veined, adnate to the lateral sepals for 0.5 mm with the sides reflexed, the lateral sepals 2–2.5 mm long, 1.5 mm wide, 1-veined, connate 0.5 mm; petals rose, cellular glandular, transversely bilobed, 0.25 mm long, 1.4 mm wide, the upper lobe narrowly oblong, obtuse, the lower lobe similar but much shorter; lip rose, bilobed, the lobes obliquely subtruncate, 1 mm long, surrounding the column, with cuneate connectives forming a broad body, adnate to the base of the column, the sinus narrow with a small, oblong, pubescent appendix; column 1 mm long, the anther and the stigma apical.

Etymology. From the Latin *vaginans*, "sheathing," referring to the column covered by the lip.

This species has features that seem to ally it with several diverse groups. The loose, flexuous, successively flowered racemes begin flowering while much shorter than the leaf, but continue to flower until much exceeding the leaf. As many as four or five flowers are often produced simultaneously. The small sepals are coarsely dentate, and the laterals are one-veined. The petals are minute and slender. The lip is bilobed without any development of marginal blades. The lobes are obcuneate and sheathe the gynostenium. A rudimentary appendix is present in the sinus between the lobes. The lip suggests section *Haplocheilus*.

Acknowledgment. I thank Dan H. Nicolson for constructive criticism.

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A New Combination in *Chonemorpha* (Apocynaceae)

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ABSTRACT. The new combination *Chonemorpha verrucosa* is made, and a key to the four species of *Chonemorpha* in Thailand is given.

Chonemorpha verrucosa (Blume) D. J. Middleton, comb. nov. Basionym: *Tabernaemontana verrucosa* Blume, Bijdr. 1029. 1826. *Rhynchodia verrucosa* (Blume) Woodson, Sunyatsenia 3: 102. 1936. TYPE: *Blume s.n.* (holotype, L; photograph in K).

Chonemorpha was first described by G. Don in 1837, although many of the 13 species he described have since been referred to other genera (see Chatterjee, 1947). The oldest name now referable to *Chonemorpha* is *C. fragrans* (Moon) Alston based on a drawing and description by Rheede (1689), which he called "Belutta-kaka-kodi," and validated as *Echites fragrans* by Moon (1824) who referred to Rheede. This species encompasses many of the subsequently published names. *Chonemorpha* is a conserved name against *Belutta-kak* Adanson, 1763.

Rhynchodia was first validly published in Bentham & Hooker (1876), although de Candolle (1844) and Miquel (1857) had previously published this genus under the names *Rhyncospermum* and *Cercocoma*, respectively. These are illegitimate later homonyms of *Rhynchospermum* Reinwardt (1828) and *Cercocoma* Wallich ex G. Don (1837). A number of species have been described over the large range of the genus, but it appears that they are all referable to one variable species.

Pichon (1950) placed both *Chonemorpha* and *Rhynchodia* in his subtribe Chonemorphinae of tribe Parsonsieae, while Lý (1986) described a new tribe, Anodendreae, containing both genera. Lý further suggested that *Chonemorpha* evolved from *Rhynchodia*. These two genera are extremely similar in leaf type, calyx and corolla structure, and stamen, disk, and gynoecium type. Because the only aspect separating the two genera is the smaller flowers in *Rhynchodia*, I believe they should be united.

Chonemorpha appears to be most closely related to *Epigynum* and *Trachelospermum*.

Kerr (1939) included two species, under the names *C. grandieriana* Pierre ex Spire and *C. macrantha* Pitard, in his list of the species in Thailand. These are synonyms of *C. fragrans* (Moon) Alston and *C. griffithii* J. D. Hooker, respectively. A key to the four species of *Chonemorpha* found in Thailand follows:

KEY TO THE SPECIES OF *CHONEMORPHA* IN THAILAND

1a. Calyx 3–4.5 mm long; corolla tube 4.3–7 mm long ..... *C. verrucosa* (Blume) D. J. Middleton
1b. Calyx 1–3.9 cm long; corolla tube 2.8–6.2 cm long.
  2a. Sepals connate for about half their length, sparsely puberulent or glabrous; corolla tube 4.7–6.2 cm long ... *C. fragrans* (Moon) Alston
  2b. Sepals connate for most of their length or almost free, densely puberulent or tomentose; corolla tube 2.8–3.9 cm long.
    3a. Sepals almost free to base ..... *C. griffithii* J. D. Hooker
    3b. Sepals connate for most of their length ..... *C. megacalyx* Pierre ex Spire

Acknowledgments. I thank the Royal Society, London, and the Royal Irish Academy, Dublin, for financial support for my work on Thai Apocynaceae, and John Parnell for comments on the manuscript.

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A New Species of *Marathrum* (Podostemaceae) from Jalisco, Mexico

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ABSTRACT. A new species of Podostemaceae, *Marathrum rubrum*, from Jalisco, Mexico, is described and illustrated. Capillaceous leaf divisions and red leaf color distinguish *M. rubrum* from other species.

RESUMEN. Se describe e ilustra una especie nueva de la familia Podostemaceae (*Marathrum rubrum*) del estado de Jalisco, México. Las divisiones capiliformes y el color rojizo de las hojas distinguen a *M. rubrum* de las otras especies.

The pantropical Podostemaceae are the largest family of aquatic flowering plants. Little taxonomic work has been conducted on New World Podostemaceae since Royen's treatments (1951, 1953, 1954). Currently most species of Podostemaceae in the New World are poorly collected, taxonomic boundaries at both the specific and generic levels are unclear, and factors relating to the unusually high incidence of endemism (e.g., > 45% among New World species) are unresolved.

Marathrum, one of the largest genera of Podostemaceae, is composed of 25 species occurring in tropical river rapids and waterfalls. The genus ranges from the West Indies and Mexico through Central America, to northwestern portions of South America (Royen, 1951). During field studies aimed at clarifying the taxonomy of Podostemaceae in Mexico, collections were made from Jalisco that did not correspond to any described species. These collections serve as the basis for the description of a new species, *Marathrum rubrum* Novelo & Philbrick.

Marathrum rubrum Novelo & Philbrick, sp. nov. TYPE: Mexico. Estado de Jalisco: municipio de Cabo Corrientes, Puente Los Horcones sobre el río, a 27 km al S de Puerto Vallarta rumbo a Chamela, 6 Mar. 1991, *Novelo & Philbrick 1003* (holotype, MEXU; isotype, RSA). Figure 1.

Herbae caule longo, prostrato, applanato; lamina iterum atque iterum pinnata, divisionibus ultimis capilliformibus, 2–4.5 mm longis, 0.02–0.06 mm latis, rubescentibus, apice acutis. Flores solitarii, axillares, pedicellati; pedicelli apice expanso, cupulato, cupula 1.5–2 mm diametro. Tepala triangularia, filamentis alternantia. Stamina 7–9 in verticillo, libera, pistillum cingentia. Antherae 1.5–2.8 mm longae. Styli liberi, conici. Fructus 4.5–5(–6) mm longus, 2 valvis, quaque 3-costata.

Aquatic herbs usually with a long prostrate and flattened stem up to 1 cm diam., strongly adhering to rocks. Leaves alternate, up to 20 cm long, petiole 2.5–9 cm long, cylindrical, up to 0.8 mm diam., with a broadened base; blade repeatedly pinnate, the later divisions capillaceous, 2–4.5 mm long, 0.02–0.06 mm wide, apex acute. Flowers hermaphroditic, actinomorphic, pedicellate, borne singly, axillary, protected by a spathella; spathella 0.7–2 cm long, thin, clavate. Pedicels 3–5.5 cm long, elongating during anthesis, with an expanded apex forming a cuplike process around the capsule base, cup 1.5–2 mm diam., with irregular border. Tepals 0.5–0.9 mm long, triangular, alternating with the stamens. Stamens 7–9, free, in a ring surrounding the pistil; filaments 2.3–4(–9) mm long, subulate, flattened, elongating during anthesis, deciduous; anthers 1.5–2.8 mm long, sagittate, basifixed, 2-celled, dehiscing longitudinally by 2 lateral slits. Ovary superior, ellipsoid, 2-locular; styles 2, 0.6–1.5 mm long, free, conical, ovules numerous, placenta axile. Fruit 4.5–5(–6) mm long and 1.7–2.2 mm diam., 2-locular capsule, suture margins thickened; valves 2, subequal, each 3-ribbed, one of them deciduous. Seeds 0.25–0.30 mm long, 0.12–0.18 mm wide, 574 (SD 317, N = 20) per capsule, obovoid. Pollen 14.5 μm (SD 0.8, N = 30) diam., tricolpate, tectum spinulose.

Paratypes. MEXICO. **Jalisco:** Municipio de Cabo Corrientes, Río Horcones, aprox. 17 km S de Puerto Vallarta rumbo a Chamela, 6 Feb. 1991, *Novelo 979* (MEXU, RSA); Puente Los Horcones sobre el río, a 27 km al S de Puerto Vallarta rumbo a Chamela, 6 Feb.

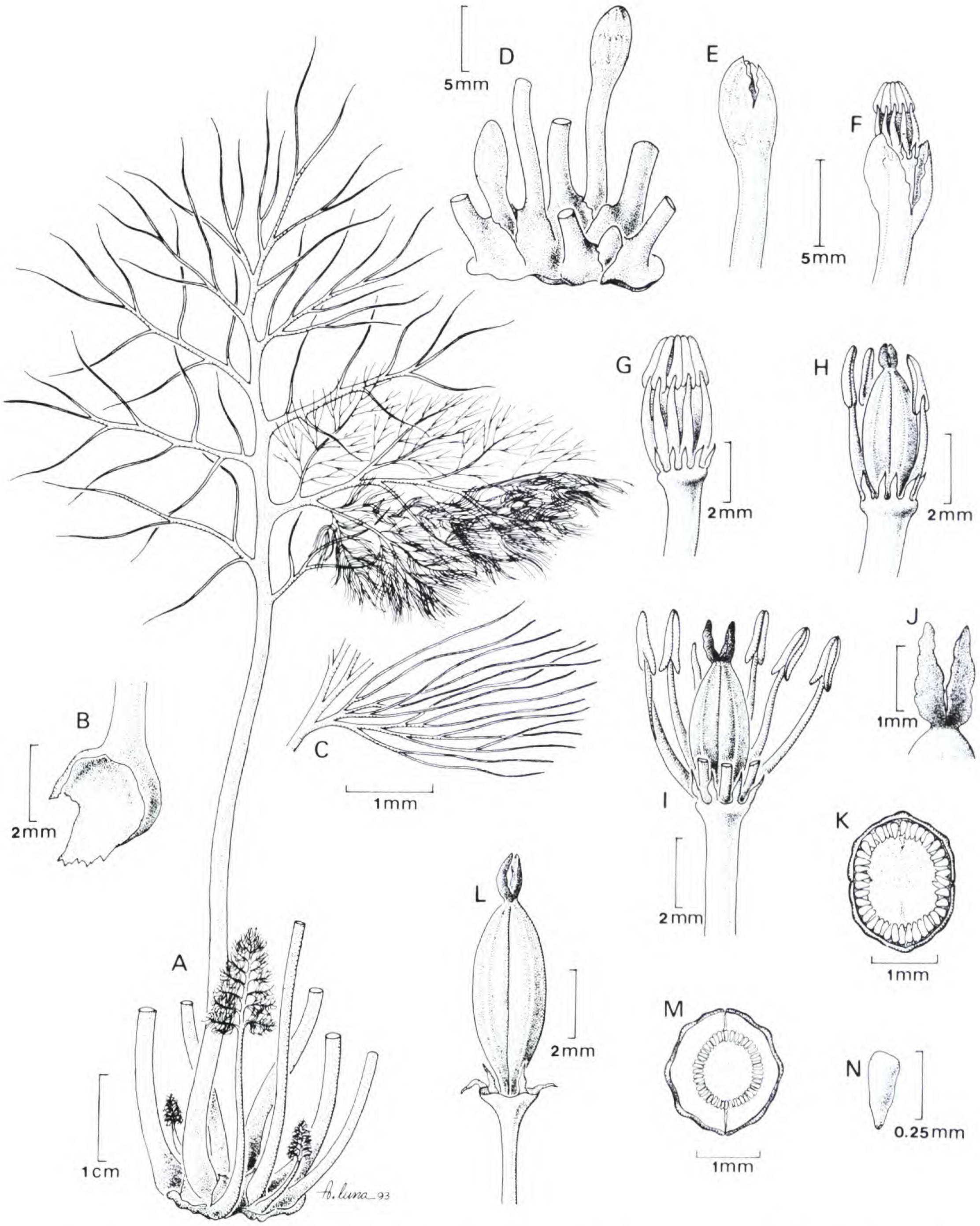

Figure 1. *Marathrum rubrum* Novelo & Philbrick. Drawings based on the holotype. —A. General habit of plant with most of the capillar divisions of the largest leaf removed. —B. Leaf base with petiole. —C. Capillar divisions of leaf. —D. Young flowers projecting from between leaf bases; each flower is covered by a spathella. —E. Flower bud as the spathella is ruptured. —F. Flower projecting through the ruptured spathella. —G. Young flower prior to anther dehiscence and stigma receptivity; note tepals. —H. Young flower with three stamens (six have been removed). —I. Mature flower showing orientation of the styles and anthers at the time of dehiscence (three stamens have been removed). —J. Mature styles with receptive stigmas. —K. Cross section of ovary showing placenta and numerous ovules. —L. Capsule showing the expanded apex of the pedicel; the stamens have been shed. —M. Cross section of a capsule showing ribs, dehiscence points of the capsule valves, and the attachment points of the valves to the placenta. —N. Seed.

1991, *Novelo 982* (MEXU, RSA), 17 Mar. 1992, *Novelo & Philbrick 1035* (MEXU).

Additional observations. *Marathrum rubrum* grows submerged in the swift currents of river rapids, attached directly to granitic boulders of various size and sometimes to submerged branches of *Salix*. Plants have been collected only in the Horcones River, Jalisco, in areas of full sun. This species often occurs on the same rock with *Vanroyenella plumosa* Novelo & Philbrick (Novelo & Philbrick, 1993), *Tristicha trifaria* (Bory ex Willdenow) Sprengel, and *Oserya coulteriana* Tulasne.

Marathrum rubrum belongs to subfamily Podostemoideae sensu Royen (1951), tribe Podostemeae. This subfamily is characterized by minute, scalelike tepals, and flowers within a single sheathlike spathella. Podostemeae is the largest tribe of New World Podostemaceae and is characterized by flowers borne singly, fascicled, or in extra-axillary inflorescences, but not in spiciform monochasia.

In addition to *Marathrum rubrum*, five other species of *Marathrum* occur in Mexico: *M. elegans* P. Royen, *M. haenkeanum* Engler, *M. schiedeanum* (Chamisso) Tulasne, *M. tenue* Liebmann, and *M. trichophorum* P. Royen. Three species (*M. elegans*, *M. haenkeanum*, *M. schiedeanum*) share with *M. rubrum* the expanded apex of the pedicel and posses five or more stamens evenly spaced around the ovary. *Marathrum tenue* and *M. trichophorum* lack the expanded pedicel apex, and possess 2–3 stamens that arise on one side of the ovary.

The leaves display the most distinctive features of *Marathrum rubrum*. It is the only species that has capillaceous leaf divisions, which range from 0.02 to 0.06 mm in diameter. In contrast, the leaf divisions of *M. haenkeanum* (0.075–0.125 mm), *M. elegans* (0.3–1.3 mm), and *M. schiedeanum* (0.1–0.4 mm) are larger in diameter.

The leaves of *M. rubrum* are distinctively red on both abaxial and adaxial surfaces. In contrast, leaves of the other species of *Marathrum* in Mexico are green, sometimes with a reddish abaxial surface.

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Notes on *Cybianthus* Subgenus *Cybianthus* (Myrsinaceae) in Southeastern Brazil

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ABSTRACT. *Cybianthus rupestris*, a new species from the Planalto of Brazil, is described and illustrated, and its phylogenetic relationships are discussed. *Cybianthus glaziovii* Mez is placed in synonymy with *C. coriaceus* Martius; the former binomial is lectotypified, the latter is neotypified, and a complete description is provided for the taxon.

The neotropical genus *Cybianthus* Martius contains approximately 160 species in 10 subgenera (Pipoly, 1987). *Cybianthus* subg. *Cybianthus* contains 55 species, distributed across the Amazon Basin, the Guayana Floristic Province (sensu Maguire, 1979), the Guianas, and central and southeastern Brazil. Members of the *Grammadenia–Cybianthus–Cybianthopsis* clade (Pipoly, 1987) possess basifixed anthers with terminal pores, or with pores that open terminally, then for a short length down each side of the thecae. However, all species of subgenus *Cybianthus* may at once be recognized by the apparently epipetalous stamens, of which the tube is developmentally fused, or entirely adnate to, the corolla tube; the apically free portions of the filaments range from 1 mm to obsolete. Members of the subgenus are only locally common. My field observations indicate that the number of individuals per population is very low, usually less than 20 individuals per hectare in primary forest. I have seen precocious flowering and architectural reiteration phenomena (sensu Pipoly, 1992), along with sexual variation, in every population thus far observed. The sexual variation observed consists of monoecy, dioecy, and often polygamy in different populations of the same species. Like the majority of *Cybianthus* species, the flowers are perfect, but functionally unisexual. Historically, the group's systematic biology has been poorly understood owing to a lack of study in population dynamics. In preparation for a treatment of the Myrsinaceae for the *Flora da Serra do Cipó*, located in Minas Gerais, a remarkable new species was found from the nearby Chapada dos Veadeiros, state of Goiás, and is described herewith.

Cybianthus rupestris Pipoly, sp. nov. TYPE: Brazil. Goiás: Chapada dos Veadeiros, 14°00′S, 47°00′W, ca. 20 km W of Veadeiros [Alto Paraíso], 1,000 m, 10 Feb. 1966 (stam. fl), *H. S. Irwin et al. 12841* (holotype, UB; isotypes, LL-TEX, NY). Figure 1.

Propter ramulos dense stellato-tomentosos, laminam coriaceam revolutamque, corollae lobos suborbiculares dense prominenteque atro punctatos, *C. coriaceo* valde affinis, sed ab ea petiolis marginatis (non canaliculatis) 0.7–1 (nec 1.5–3) cm longis, perianthio membranaceo (non chartaceo), calyce inequilater (non equilater) diviso, lobis corollinis subapicale incisuris (non integerrimis) secus margines, glandulari-fimbriatos (nec glandulari-granulosos), antheris glabris (non minute glandulari-papillatis), denique stigmate capitato (non 4-lobato) praeclare distat.

Shrub to small tree to 2 m tall, stems to 3 cm diam.; branchlets terete, 3.5–5 mm diam., densely ferrugineous floccose-tomentose, the tomentum composed of stiff, arachnoid-stellate trichomes. Leaves coriaceous, the blades linear-oblanceolate to narrowly oblanceolate, (4–)4.5–9 cm long, 0.8–1.9 cm wide, apex acute, base cuneate, nitid and essentially glabrous above, pallid and densely ferrugineous floccose-tomentose below along the midrib and margin, glabrescent, midrib impressed above, prominently raised below, secondary veins 10–15 pairs, the margin tightly inrolled-revolute, entire; petioles marginate, 0.7–1 cm long, basally pulvinate, glabrous above, densely tomentose below, glabrescent. *Staminate inflorescence:* a simple, erect raceme, 5–7.5(–8) cm long, the peduncle, rachis and pedicels densely tomentose; peduncle 0.8–1 cm long; floral bracts linear-lanceolate, 1.4–1.8 mm long, apex attenuate, densely tomentose above and below, the margin erose, long glandular-ciliate; pedicels cylindrical, thin, 2.8–4.6 mm long. Flowers nodding, 2.6–2.9 mm long, dull yellow-green; calyx membranaceous, cotyliform, 1.2–1.6 mm long, the tube 0.2–0.4 mm long, unequally divided, the lobes suborbicular, 0.7–0.9 mm long, 0.7–1.1 mm wide, apically rounded, hyaline, densely and prominently black punctate-lineate, the margin erose, mostly subapically notched, densely glandular-ciliate, the cilia

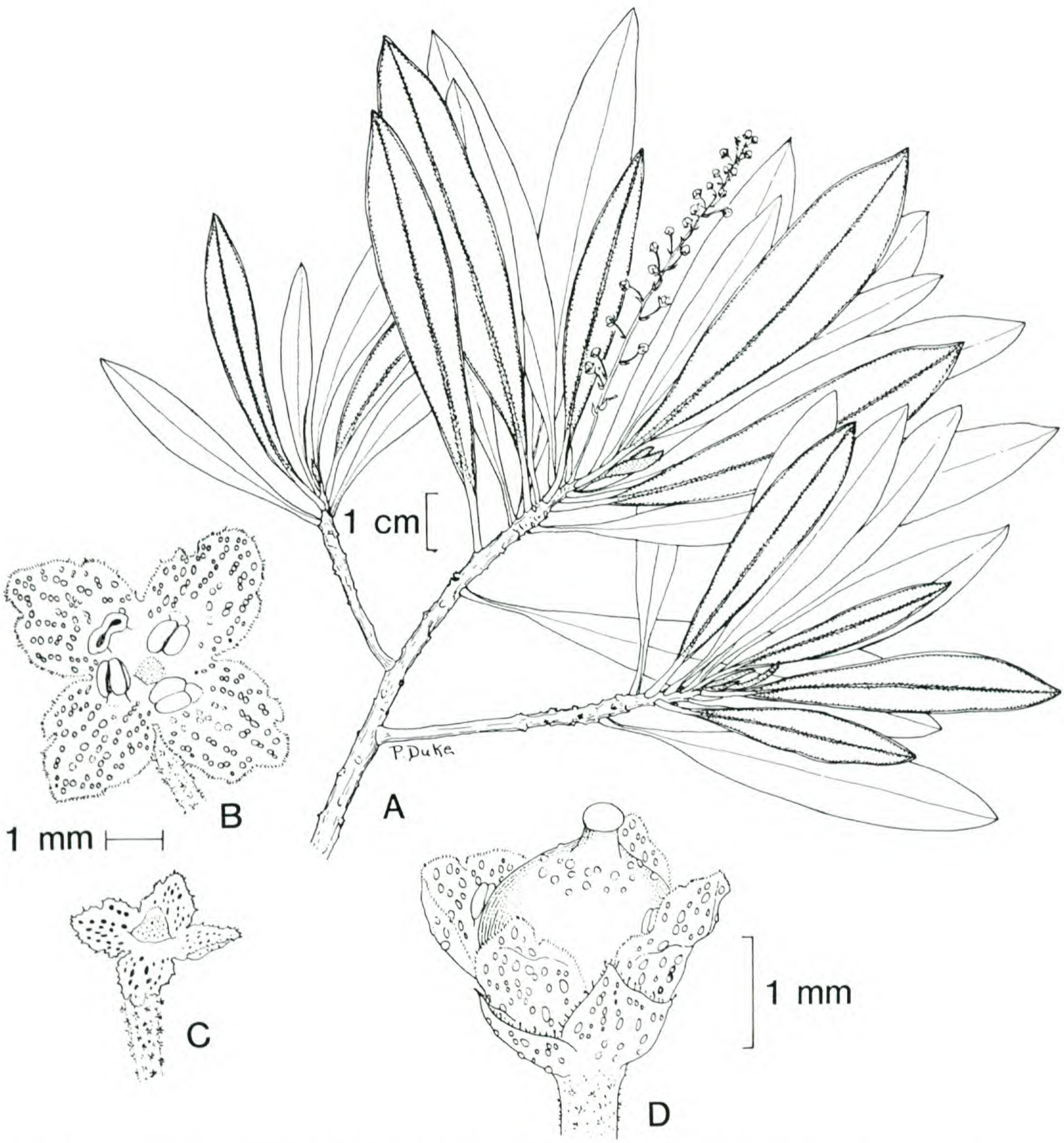

Figure 1. *Cybianthus rupestris* Pipoly. —A. Habit, showing revolute, tomentose leaves. —B. Staminate flower, showing subapically notched corolla lobes. —C. Staminate calyx and pistillode, showing erose calyx lobe margins and glandular-granulose pistillode. —D. Pistillate flower, showing discoid stigma and translucent glandular-lepidote ovary. A–C drawn from isotype. D drawn from *H. S. Irwin 32765*.

long, 3–5-celled, ferrugineous; corolla membranaceous, subrotate, 2.5–2.8 mm long, the tube 0.7–0.9 mm long, the lobes suborbicular, asymmetric, 1.8–2.2 mm long and wide, apex broadly obtuse, subapically notched, glabrous without, densely glandular-granulose throughout within, prominently black punctate medially, the margins glandular-fimbriate, the fimbria ferrugineous; stamens 1.8–2.2 mm long, the tube inconspicuous, membranaceous, adnate to corolla tube, 0.3–0.4 mm long, the filaments flat, 0.5–0.6 mm long, densely glandular-granulose, the anthers very widely ovate to suborbicular, 0.6–0.7 mm long, 0.7–0.8 mm wide, apex broadly rounded, base cordate, glabrous, the connective prominently punctate dorsally; pistillode conic, ca. 0.9 mm long, 0.4 mm diam., densely and prominently black punctate and glandular-granulose. *Pistillate inflorescence:* a simple, stiff, erect raceme, (1.5–)2–3.5(–4) cm long, the peduncle, rachis, and pedicels densely tomentose; peduncle 0.4–0.6 cm long; floral bracts

linear-lanceolate, 1–1.4 mm long, apex attenuate, densely tomentose above and below, the margin erose, long glandular-ciliate; pedicels cylindrical, thin, 1.5–1.8 mm long. Flowers nodding, 1.9–2.3 mm long, dull yellow-green; calyx membranaceous, cotyliform, 0.9–1.1 mm long, the tube 0.1–0.2 mm long, unequally divided, the lobes suborbicular to ovate, 0.7–0.9 mm long, 0.7–1.1 mm wide, apically rounded to subacute, hyaline, densely and prominently black punctate-lineate, the margin erose, mostly subapically notched, densely glandular-ciliate, the cilia long, 3–5-celled, ferrugineous; corolla membranaceous, subrotate, 1.8–2 mm long, the tube 0.7–0.9 mm long, the lobes suborbicular, asymmetric, 1.2–1.4 mm long and wide, apex broadly obtuse, subapically notched, glabrous without, densely glandular-granulose throughout within, prominently black punctate medially, the margins glandular-fimbriate, the fimbria ferrugineous; staminodes 1.3–1.5 mm long, the tube inconspicuous, membranaceous, adnate to corolla tube, 0.6–0.7 mm long, the filaments flat, 0.2–0.3 mm long, densely glandular-granulose, the anthers very widely ovate to suborbicular, 0.3–0.4 mm long and wide, apex broadly rounded, base cordate, glabrous, the connective prominently punctate dorsally; pistil obturbinate, 1.3–1.5 mm long, the ovary 0.8–0.9 mm long, 0.7–0.9 mm wide, densely and prominently black punctate and glandular-granulose, the style 0.4–0.5 mm long, the stigma capitate, flat, discoid, the placenta subglobose, apex apiculate, ovules 3, deeply imbedded in the placenta. Fruit subglobose, 5–7 mm long and in diam., exocarp thin, reddish brown when dried, inconspicuously pellucid punctate.

Distribution. Endemic to the Chapada dos Veadeiros, Goiás, Brazil, at 1,000–1,600 m elevation.

Ecology. Cybianthus rupestris grows in gallery forests along rivers, at the margin of cerrado formations. It appears to be locally common and forms a conspicuous element of the understory.

Paratypes. BRAZIL. **Goiás:** Chapada dos Veadeiros, 20 km N of Alto Paraiso, 1,250 m, 20 Mar. 1966 (pist. fl, fr) *H. S. Irwin et al. 32765* (NY, UB), *32765A* (MO, NY, UB); ca. 1,600 m, 6 Mar. 1973 (fr), *W. R. Anderson 6501* (IAN, NY, UB).

Cybianthus rupestris is most closely related to the vicariant *C. coriaceus* Martius, but is easily recognized by its shorter, marginate petioles, unequally divided calyx, subapically notched corolla lobes with glandular-fimbriate margins, glabrous anthers, and capitate, discoid stigma.

Upon study of *Cybianthus glaziovii* Mez, as the closest congener of *C. rupestris*, it became apparent that *C. coriaceus* is the earliest name for the taxon. Mez (1902) separated the two species based on an overlapping character state of acutish to acuminate vs. acute or obscurely acuminate leaf apex, and the prominence of the secondary venation below. However, I have examined all material seen by Mez, except the holotype of *C. coriaceus* and can find no differences. Because the holotype of *C. coriaceus* has been lost, and no other element was mentioned in the protologue, a neotype is proposed for *C. coriaceus*. *Cybianthus glaziovii* is lectotypified. A complete description, not previously available, is provided below.

Cybianthus coriaceus Martius, Flora (Beibl.) 2(2): 19. 1841. TYPES: Brazil. San Sebastian [Rio de Janeiro]: *C. Martius s.n.* (holotype, M lost). NEOTYPE: Brazil. Rio de Janeiro: Rio de Janeiro, summit, Morro do Carangola, 22 Oct. 1882 (stam. fl), *A. Glaziou 14048* (neotype, here designated, P; isoneotypes, BR, C, G, K, RB).

Cybianthus glaziovii Mez in Engler, Pflanzenr. IV. 236 (9): 227. 1902, syn. nov. TYPE: Brazil. Rio de Janeiro: Serra dos Orgãos, 12 Aug. 1888 (stam. fl), *A. Glaziou 17121* (lectotype, here designated, C; isolectotypes, K, P, RB).

Shrub or small tree to 4 m tall; branchlets angulate, 3.5–5 mm diam., densely ferrugineous furfuraceous stellate-tomentose. Leaves coriaceous, the blades elliptic to oblanceolate, (3–)6–8(–11.5) cm long, (1.5–)2–3.5 cm wide, apex acute to acuminate, submucronate, base cuneate, drying grayish, ferrugineous furfuraceous stellate-tomentose, glabrescent, and scrobiculate above, densely stellate-tomentose below, the tomentum persistent on the midrib and near margin, midrib impressed above, prominently raised below, secondary veins 10–15 pairs, the margin opaque, highly revolute, entire; petioles canaliculate, (1.5–)2–2.5(–3) cm long, not pulvinate, densely tomentose, glabrescent. *Staminate inflorescence:* a simple, erect raceme, (3–)5–8(–11) cm long, the peduncle, rachis, and pedicels densely tomentose; peduncle 1–1.5 cm long; floral bracts linear, 1.7–2 mm long, 0.2–0.3 mm wide, apex attenuate, densely tomentose above and below, the margin irregular, somewhat erose, glabrous; pedicels cylindrical, thin, 4–5 mm long. Flowers nodding, 2.4–2.9 mm long, translucent green; calyx chartaceous, cotyliform, 1.4–1.6 mm long, the tube 0.2–0.3 mm long, equally divided, the lobes ovate-triangular, 1.1–1.2 mm long, 0.7–0.8 mm wide, apex acute, densely and prominently black punctate, the margin hyaline, erose, densely glandular-ciliate;

corolla chartaceous, subrotate, 2.3–2.8 mm long, the tube 0.5–0.8 mm long, the lobes suborbicular, symmetric, 1.8–2.1 mm long, 1.2–1.5 mm wide, apex rounded, densely black punctate, glabrous without, densely glandular-granulose throughout within, the margin entire, glandular-granulose; stamens 1.3–1.5 mm long, the tube inconspicuous, 0.5–0.8 mm long, the filaments flat, 0.4–0.5 mm long, proximally recurved, glabrous, the anthers suborbicular, 0.5–0.6 mm long and wide, apex obtuse, base rounded, densely and minutely rufous glandular-granulose dorsally, the connective prominently black punctate dorsally; pistillode subcylindrical, somewhat tapered apically, 0.7–1 mm long, 0.5–0.6 mm diam., the stigma truncate, hollow, densely glandular-papillate. *Pistillate inflorescence:* a simple, erect raceme, 3.5–5 cm long, the peduncle, rachis, and pedicels densely tomentose; peduncle 0.4–0.7 cm long; floral bracts linear, 1.4–1.8 mm long, 0.2–0.3 mm wide, apex attenuate, densely tomentose above and below, the margin irregular, somewhat erose, glabrous; pedicels cylindrical, thin, 1.6–2 mm long. Flowers nodding, 2.6–2.9 mm long, translucent green; calyx chartaceous, cotyliform, 1.1–1.3 mm long, the tube 0.2–0.3 mm long, equally divided, the lobes deltate to very widely ovate, 0.9–1 mm long, 1–1.1 mm wide, apex acute, densely and prominently black punctate, the margin hyaline, erose, densely glandular-ciliate; corolla chartaceous, subrotate, 2.5–2.8 mm long, the tube 0.6–0.8 mm long, the lobes suborbicular, symmetric, 1.8–2 mm long, 2–2.2 mm wide, apex rounded, densely black punctate, glabrous without, densely glandular-granulose throughout within, the margin entire, glandular-granulose; staminodes 1.2–1.5 mm long, the tube inconspicuous, 0.6–0.8 mm long, the filaments flat, 0.2–0.3 mm long, proximally recurved, glabrous, the anthers suborbicular, 0.5–0.6 mm long and wide, apex obtuse, base rounded, densely and minutely rufous glandular-granulose dorsally, the connective prominently black punctate dorsally; pistil cylindrical, 1.6–1.8 mm long, 1–1.2 mm diam., the ovary densely translucent glandular-lepidote, gradually tapered to the 4-lobed stigma, the placenta deeply cupuliform, the ovules 3, deeply buried in the placenta. Fruit subglobose, 4–5 mm long and in diam., exocarp thin, inconspicuously pellucid punctate.

Distribution. Southeastern Brazil, in the states of Minas Gerais and Rio de Janeiro.

Representative specimens examined. BRAZIL. **Minas Gerais:** Ouro Preto, near Camasinhos, 6 June 1905 (pist. fl), *L. Damay 971* (G-BOIS, G-DC); Serra do Ouro Preto, Apr. 1892 (fr), *E. Ule 2629* (B destroyed, F, HBG). **Rio de Janeiro:** Tijuca, 22 July 1864 (stam. fl), *A. Glaziou 895* (BR, C, P—2 sheets); Serra dos Orgãos, 12 Aug. 1888 (pist. fl, fr), *A. Glaziou 17120* (P).

Cybianthus coriaceus is known only from historical collections and may be extinct or exceedingly rare. It may be immediately separated from *C. rupestris* by the canaliculate petioles, chartaceous perianth, and minutely glandular-papillate anthers.

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The Genus *Geissanthus* (Myrsinaceae) in the Chocó Floristic Province

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ABSTRACT. Studies on the plant diversity of Las Orquídeas National Park in Antioquia, Colombia, along with preparation of a treatment of the Myrsinaceae for *Flora de Colombia*, resulted in the discovery of four new taxa and two new combinations in *Geissanthus*. Examination of species known from the entire Western Cordillera of Colombia and the Chocó Floristic Province, from Panama to Ecuador, resulted in the discovery of 17 species from the area. An artificial key to the species of *Geissanthus* from the Chocó and Western Cordillera is presented, along with descriptions of four new species, *G. callejasii*, *G. betancurii*, *G. francoae*, and *G. cogolloi*. Three new combinations are made, *G. longistamineus*, *G. perpuncticulosus*, and *G. scrobiculatus*, and revised descriptions based on complete material are presented for *G. longistamineus* and *G. perpuncticulosus*.

RESUMEN. Como resultado de los estudios de la fitodiversidad del Parque Nacional Natural "Las Orquídeas," Antioquia, Colombia, y de actividades preliminares al tratamiento de Myrsinaceae para *Flora de Colombia*, se presentan cuatro taxa nuevos y tres nuevas combinaciones en el género *Geissanthus*. Al estudiar los especímenes de la Cordillera Occidental de Colombia y la provincia florística chocoana desde Panamá hasta Ecuador, se reconocieron 17 especies en la zona. Se presenta una clave artificial para separarlos, se describen las cuatro especies nuevas, *G. callejasii*, *G. betancurii*, *G. francoae*, y *G. cogolloi*, y se publican las tres nuevas combinaciones, *G. longistamineus*, *G. perpuncticulosus*, y *G. scrobiculatus;* además se proveen descripciones revisadas para *G. longistamineus* y *G. perpuncticulosus* basadas en el estudio de material completo.

Determination of collections from an ongoing floristic study of Parque Nacional Natural "Las Orquídeas," jointly conducted by the Fundación Jardín Botánico, "Joaquín Antonio Uribe" (JAUM) and the Missouri Botanical Garden (MO), concomitant with preparation of a taxonomic treatment of the Myrsinaceae for *Flora de Colombia*, required a review of the species of *Geissanthus* J. D. Hooker from the Cordillera Occidental of Colombia and the adjacent Chocó Floristic Province (sensu Gentry, 1982), which extends from the Darién of Panama southward to Los Ríos, Ecuador.

The genus *Geissanthus* was circumscribed by Bentham (1876) to include 11 taxa from the Andes, which he did not list, nor make the necessary combinations. Bentham described the genus as polygamo-dioecious, with a 3–5-lobed calyx, infundibuliform, 5-lobed corolla, linear-oblong anthers, and terminal panicles with spicate branches. The basis of his opinion that the taxa were polygamo-dioecious was the fact that fruit production per inflorescence branch is extremely low. After examining a number of species, I have concluded that there is a continuum from wholly staminate to wholly pistillate plants, but the most frequent condition is polygamous; the position of flowers for any particular sex on the inflorescence is apparently random. The flowers of each species appear to be monomorphic, the staminate ones of normal size but with hollow pistillodes, and the pistillate ones having staminodes slightly shorter, but normal-sized anthers, devoid of pollen.

In his worldwide monograph of the family, Mez (1902) distinguished *Geissanthus* from the other genera of the tribe Myrsineae by its free stamens, dorsifixed anthers, and the calyx closed in bud, opening later into irregular lobes. In that treatment, 25 species were recognized, of which 17 were new. Subsequent to that treatment, miscellaneous new species were added by Mez (1905, 1920), Macbride (1934), and Cuatrecasas (1951).

Agostini (1970) was the first worker since Mez to discuss generic delimitation among taxa assigned to *Conomorpha* A. DC. and *Stylogyne* A. DC. Agostini distinguished *Geissanthus* from *Stylogyne* and what was at that time the *Cybianthus* complex of genera (including *Conomorpha*), based on a combination of several characters, including: the terminal inflorescence; sessile or subsessile flowers; calyx lobes at first closed, then rupturing into 2–8 unequal segments; the petals fused ⅓ or more their length; and capitate stigma. Using those criteria, he transferred three taxa from *Conomorpha* and one taxon from *Stylogyne* into *Geissanthus*.

My studies have revealed that *Geissanthus* may be defined by its unique calyx, which is closed in bud and opens into 2–8 usually unequal lobes, co-

rolla with linear or oblong petals that are distally recurved at least 180° in anthesis, and the subversatile or versatile anthers, which are latrorsely dehiscent by wide or narrow longitudinal slits. *Stylogyne* may easily be separated from *Geissanthus* by its contorted corolla, with the lobe tips highly twisted in bud. *Cybianthus* may be separated from *Geissanthus* by its axillary inflorescences, stamens connate by their filaments to form a tube, the staminal tube adnate to the corolla tube, and the glandular granules present at least at the junction of corolla lobes and tube.

The present study has revealed 17 species of *Geissanthus* in the region, clearly the most diverse zone for the genus. Synonymies are given where appropriate, and complete descriptions are given only when new data have been revealed as a result of this study. Because there are perhaps an additional six undescribed taxa known from fragmentary material, the present key is tentative until a broader survey can be conducted.

Morphological terminology follows Lindley (1848) and Pipoly (1987, 1992). The 17 species of *Geissanthus* occurring in the region may be distinguished by the following artificial key.

KEY TO THE SPECIES OF *GEISSANTHUS* IN THE CORDILLERA OCCIDENTAL AND ADJACENT CHOCÓ FLORISTIC PROVINCE

1a. Leaves coriaceous, the margins revolute.
  2a. Inflorescence longer than the leaves.
    3a. Leaf blades 4–18.5 cm wide; inflorescence branches spicate.
      4a. Leaf blades bullate; petioles deeply canaliculate.
        5a. Branchlets and leaves rufous stellate-tomentose; leaf margin entire; pedicels 0.3–0.5 mm long ..... *G. callejasii* Pipoly
        5b. Branchlets furfuraceous-lepidote; leaf margin serrate; pedicels 2–3 mm long ..... *G. serrulatus* (Willdenow ex Roemer & Schultes) Mez
      4b. Leaf blades smooth; petioles marginate.
        6a. Branchlets angulate; corolla membranaceous ..... *G. betancurii* Pipoly
        6b. Branchlets terete; corolla coriaceous ..... *G. occidentalis* Cuatrecasas
    3b. Leaf blades 1.5–3.5 cm wide; inflorescence branches corymbose.
      7a. Leaf margins serrate; petioles 1.5–2.1 cm long; pedicels obsolete ..... *G. goudotianus* Mez
      7b. Leaf margins entire; petioles 0.5–1 cm long; pedicels 1.5–4 mm long ..... *G. quindiensis* Mez
  2b. Inflorescence shorter than or subequaling the leaves.
    8a. Branchlets angulate; leaf blades decurrent to petiole base; petioles marginate; panicles columnar.
      9a. Branchlets and inflorescence rachis glabrous; leaf blades nitid above; petioles 1–1.4 cm long ..... *G. ecuadorensis* Mez
      9b. Branchlets and inflorescence densely and minutely furfuraceous-lepidote; leaf blades sordid above; petioles 1.7–3.5 cm long ..... *G. longistylus* (Cuatrecasas) Agostini
    8b. Branchlets terete; leaf blades only slightly decurrent on the petiole; petioles deeply canaliculate; panicles pyramidal.
      10a. Leaf blades nitid above, the bases acute, the margins entire; pedicels obsolete; calyx obconic basally ..... *G. kalbreyeri* Mez
      10b. Leaf blades sordid above, the bases truncate, the margins serrate; pedicels 2.5–3.5 mm long; calyx truncate basally ..... *G. argutus* (Kunth) Mez
1b. Leaf blades membranaceous to chartaceous, the margins flat.
  11a. Leaf blades densely and prominently black perpuncticulose, or punctate and punctate-lineate.
    12a. Leaf blades oblong, elliptic, or narrowly oblanceolate, asymmetric, 2–5 cm wide.
      13a. Leaf blades nitid above; floral bracts cucullate; pedicels 1.8–2.5 mm long ..... *G. cestrifolius* (Kunth) Mez
      13b. Leaf blades sordid above; floral bracts flat; pedicels 2.5–3 mm long .... *G. cogolloi* Pipoly
    12b. Leaf blades widely oblanceolate to obovate, symmetric, 6–18 cm wide.
      14a. Petioles 0.5–1 cm long; calyx membranaceous, 2.7–3.2 mm long, black punctate-lineate ..... *G. angustiflorus* Cuatrecasas
      14b. Petioles 1–1.5 cm long; calyx chartaceous, 1.2–1.7 mm long, orange punctate ..... *G. perpuncticulosus* (Lundell) Pipoly
  11b. Leaf blades pellucid punctate or punctate-lineate, or inconspicuously black punctate and punctate-lineate (the glands not raised).
    15a. Branchlets quadrangular; leaf blades densely fufuraceous-lepidote below, the scales overlapping and appearing velutinous, the blade margin serrate; inflorescence from ⅔ to subequaling leaf length ..... *G. francoae* Pipoly
    15b. Branchlets terete; leaf blades sparsely furfuraceous-lepidote, not appearing velutinous, the blade margin entire; inflorescence ca. ⅓–½ leaf length.
      16a. Leaf blades scrobiculate above; calyx lobes hyaline, the margins regular, erose ..... *G. scrobiculatus* (Cuatrecasas) Pipoly
      16b. Leaf blades smooth above; calyx lobes opaque, the margins irregular, entire ..... *G. longistamineus* (A. C. Smith) Pipoly

NEW SPECIES OF *GEISSANTHUS*

Geissanthus callejasii Pipoly, sp. nov. TYPE: Colombia. Antioquia: Mcpio. Jardín, Alto de Ventanas, 15 km SW of Jardín, on road to Riosucio, 2,400–2,800 m, 05°30′N, 75°50′W, 9 June 1987 (infl. bud, fr), *R. Callejas, O. Marulanda, F. Roldán & H. Correa 3916* (holotype, HUA; isotypes, MO Nos. 3702266, 3702267).

Propter laminam coriaceam ellipticam vel oblanceolatam bullatamque, inflorescentiam quasi latam quam longiorem ramulam subspicatamque, lobos calycinos longitudine latitudos aequantes, *G. bogotensi* arcte similis, sed ab ea ramulis angulatis (non teretibus) dense rufostellati-tomentosis (nec dense adprese lepidoti), petiolis profunde canaliculatis (non late marginatis) 1.2–2 (nec 2–3) cm longis, lobis calycinis suborbicularibus vel ovatis (nec triangularibus), corollis 4.3–4.6 (non 3.2–4) mm longis, denique lobis corollinis oblongis (nec ovato-triangularibus) statim separabilis.

Tree to 4 m tall; branchlets strongly angulate, longitudinally ridged, 5–7 mm diam., densely rufous stellate-tomentose, persistent. Leaves alternate, the blades stiffly coriaceous, elliptic or rarely oblanceolate, (11–)14.5–17(–21) cm long, (4–)6–8.5 cm wide, apex acute, base acute, decurrent on the petiole, midrib and secondary veins deeply impressed above, decurrent to petiole base, prominently raised below, secondary veins 12–17 pairs, rufous stellate-tomentose above at first, early glabrescent, the resulting remnant pits from fallen trichomes giving a scrobiculate appearance, densely rufous stellate-tomentose below, the hairs at times with all branches pointing upwards from leaf surface, inconspicuously brown punctate and punctate-lineate, the margin entire, somewhat revolute; petiole deeply canaliculate, (1.2–)1.4–1.8(–2) cm long, densely and persistently rufous stellate-tomentose above and below. Inflorescence terminal, pyramidal bipaniculate, 9–17 cm long, 8–14 cm wide, the secondary branches 7–9 cm long toward base; peduncle, rachis, bracts, and pedicels densely rufous stellate-tomentose, the trichomes persistent; inflorescence bract unknown; peduncle obsolete to 2 cm; primary branch bracts unknown; secondary branch bracts membranaceous, oblong, 4–4.3 mm long, 2.8–3 mm wide, apex truncate, densely stellate-tomentose below, glabrous, densely and prominently black punctate and punctate-lineate within, the margin stramineous, entire, glabrous; floral bracts membranaceous, 1.3–1.5 mm long, 0.5 mm wide, apex obtuse, densely stellate-tomentose below, prominently black lineate within, the margin hyaline, glabrous, early caducous; pedicels cylindrical, 0.3–0.5 mm long. Flowers erect, green; fruiting calyx coriaceous, (2–)3–5-lobed, 2.4–3.1 mm long, the tube 0.3–0.7 mm long, extremely unequally divided, the lobes suborbicular to ovate, 2.1–2.8 mm long, 2.1–2.8 mm wide, apex acute, asymmetric, densely rufous stellate-tomentose medially without, glabrous within, inconspicuously black punctate, the margin scarious, hyaline, glabrous, undulate, and at times appearing erose; corolla membranaceous, campanulate, 4.3–4.6 mm long, the tube 1.2–1.3 mm long, the lobes oblong, 3.1–3.4 mm long, 1.4–1.5 mm wide, apex obtuse, reflexed 180° at anthesis, sparsely and prominently red punctate and punctate-lineate, the margin irregular, somewhat erose; stamens and pistil unknown. Fruit globose, 5–7 mm long and in diam., fruit green; densely and prominently black punctate and punctate-lineate, the exocarp thin.

Distribution. Geissanthus callejasii is known only from the type, from the Western Andean Cordillera, Alto de Ventanas, which is north of Cerro Caramanta, in an area where the broken terrain yields north–south-facing slopes, at 2,400–2,800 m elevation.

Ecology. This species is known to be occasional, near small watercourses in the montane and upper premontane wet forests.

Etymology. It is with great pleasure that I dedicate this species to Ricardo Callejas Posada, professor and curator of the herbarium of the Universidad de Antioquia; a friend, colleague, and preeminent authority on the morphogenesis, anatomy, and systematics of the Piperaceae.

With elliptic or rarely oblanceolate, coriaceous, and bullate leaves, panicles almost as wide as long, and calyx lobes as long as wide, *Geissanthus callejasii* is most similar to *G. bogotensis* Mez. However, the angulate and rufous stellate-tomentose branchlets, shorter, deeply canaliculate petioles, suborbicular or ovate calyx lobes, and oblong corolla lobes easily set *Geissanthus callejasii* apart.

Geissanthus betancurii Pipoly, sp. nov. TYPE: Colombia. Antioquia: Mcpio. Urrao, on trail to Páramo de Frontino, near Finca El Quince, 06°30′N, 76°10′W, 2,900 m, 18 Nov. 1988 (fl), *G. McPherson, F. Roldán & J. Betancur 13106* (holotype, HUA; isotypes, COL, MO, US). Figure 1.

Quoad ramulos subteretos, furfuraceo-lepidotos corticemque horizontaliter rimosem, laminas coriaceas obovatas ad apices acutas vel subacuminatas, petiolos marginatos, pedicelos obsoletos vel obconicos, inflorescentiam pyramidali-panicutam, *G. fragranti* valde affinis, sed ab ea ramulis 3.5–6 (non 7–10) mm diametris, laminis secus margines revolutis (non planis), pedicelis 0.2–0.3 mm longis (nec obsoletis), calyces coriaceis (non chartaceis),

antheris ovoideis (non oblongoideis) ad apices truncatis (nec apiculatis), connectivis epunctatis (nec atro-punctatis) praeclare distat.

Tree to 12 m tall; branchlets subterete to angulate, 3.5–6 mm diam., sparsely ferrugineous, furfuraceous-lepidote, the bark horizontally checked, glabrescent. Leaves alternate, the blades coriaceous, obovate, (10.5–)12.5–16 cm long, (4.3–)5–6(–7.4) cm wide, apex acute to subacuminate, base cuneate, decurrent on the petiole, midrib impressed above, prominently raised below, secondary veins inconspicuous, (18–)22–26(–30) pairs, smooth, sordid and glabrous above, pallid, moderately and minutely furfuraceous-lepidote below, sparsely and inconspicuously reddish black punctate, the margin revolute, entire, glabrous; petioles marginate, (1.3–)1.5–2 cm long, glabrous above, densely and minutely ferrugineous furfuraceous-lepidote below, glabrescent. Inflorescence terminal, a pyramidal pinnate panicle, (10–)13–18(–21) cm long, 10–19 cm wide at base, inflorescence bract unknown; peduncle, rachis, secondary branches and pedicels moderately and minutely rufous glandular-papillate, glabrescent; inflorescence bract unknown; peduncle ca. 1 cm long; secondary branch bracts unknown; floral bracts unknown; pedicels obsolete or obconic to 0.2–0.3 mm long. Flowers erect, white; calyx coriaceous, obconic, (2–3)4–5(–6)-lobed, 3.3–3.6 mm long, the tube 2.1–2.4 mm long, very unequally divided, densely translucent and rufous furfuraceous-lepidote without, the lobes widely ovate to narrowly lanceolate, 2.1–2.2 mm long, 0.7–1.8 mm wide, apex obtuse on wider lobes, acutish on narrower ones, densely and prominently brown punctate and orange punctate-lineate, the margin scarious, irregular, entire to subentire, glabrous; corolla carnose, campanulate, 4–5(–6)-lobed, 4.9–5.6 mm long, the tube 2.1–2.5 mm long, the lobes ovate, 2.5–3.1 mm long, 1.6–1.8 mm wide, apex acute, translucent, prominently brown punctate, glabrous, the margins irregular, entire, glabrous; stamens free, 4.9–5.6 mm long, the filaments membranaceous, flat, 3.8–4 mm long, hyaline, glabrous, not widened basally, inserted at corolla tube base, anthers versatile, ovoid, 1.7–1.9 mm long, 1–1.2 mm wide, apex truncate, base deeply cordate, longitudinally dehiscent by wide latrorse longitudinal slits, the connective hyaline, epunctate; pistil obturbinate, 3.8–4.4 mm long, the ovary 1.6–1.8 mm long, 0.7–0.8 mm diam., the style 2–2.2 mm long, the stigma capitate, the placenta subglobose, 0.3–0.4 long and in diam., apiculate, the ovules 4, buried in the placenta. Fruit depressed-globose, 8–12 mm long, 10–13 cm wide, reddish violet at maturity, densely and prominently black punctate and punctate-lineate, the exocarp thin.

Distribution. Endemic to the northern sector of the Cordillera Occidental and facing western slopes of the Cordillera Central, in the Department of Antioquia, Colombia, at 1,500–2,900 m elevation.

Ecology. Geissanthus betancurii is a rare forest treelet, growing in areas near creekbeds, on steep slopes.

Etymology. It is with great pleasure that I dedicate this species to Julio Betancur (COL), prodigious field botanist and specialist in neotropical Bromeliaceae.

The following characters indicate that *Geissanthus betancurii* is closely related to *G. fragrans* Mez, of the Venezuelan Coastal Cordillera: subterete, furfuraceous-lepidote branches with horizontally fissuring bark; coriaceous, acute or subacuminate leaves with marginate petioles; and pyramidally paniculate inflorescences with short, obconic or absent pedicels. However, *G. betancurii* may be easily recognized by its thinner branchlets, revolute leaves, short-pedicellate flowers with coriaceous calyx lobes, and ovoid anthers with truncate apices and epunctate connectives.

Paratypes. COLOMBIA. **Antioquia:** Mcpio. San Luís, Piedra del Castrillón, Cordillera Central, Ladera Oriental, 06°4′30″N, 74°59′74″W, 1,500–1,700 m, 16 Sep. 1988 (fr), *J. Betancur et al. 664* (COL, HUA, MO, US); Cordillera Occidental, 3–4 hours on foot SW of town, 06°01′N, 75°01′W, 1,500 m, 12 Aug. 1987 (fr), *D. Daly & J. Betancur 5335* (COL, HUA, MO, US).

Geissanthus francoae Pipoly, sp. nov. TYPE: Colombia. Risaralda: Mcpio. de Pereira, El Cedral, old road to Salento, 2,200–2,300 m, 11 June 1989 (fl), *G. Galeano, P. Franco, N. Ladino, E. Forero & A. Castillo 1955* (holotype, COL; isotype, MO). Figure 2.

Ob ramulos angulatos, adprese-ferrugineo-furfuraceo-lepidotos, folia pseudoverticillata, flores pedicellatos, calycem glandulari-papillatum, anthera lanceloideas, subversatiles necnon pistillo obturbinato, *G. perpuncticuloso* valde arcte affinis, sed ab ea laminis chartaceis (non membranaceis) subter squamis lepidotis superpositis sic a velvetum similis (nec dissite praeditis), secus margines serratis (nec integerrimis), petiolis (2–)2.5–3 (non 1–1.5) cm longis, calyce membranaceo (non chartaceo) urceolato (nec cupuliforme), corolla membranacea (non chartacea) 3–3.2 (nec 2.4–2.7) mm longa, antheris ad apices emarginatis (non obtusis), denique in sylvas montanas nebulosasque (non premontanas) incolens, facile distinguitur.

Shrub or small tree to 4 m tall; branchlets quadrangular, the angles subalate, 7–12 mm diam., densely ferrugineous furfuraceous-lepidote, the scales appressed, the scale margins overlapping, persistent. Leaves pseudoverticillate, chartaceous, the blades oblanceolate, (29–)32–39(–54) cm long, (9–)10–13(–16) cm wide, apex short-acuminate, the acu-

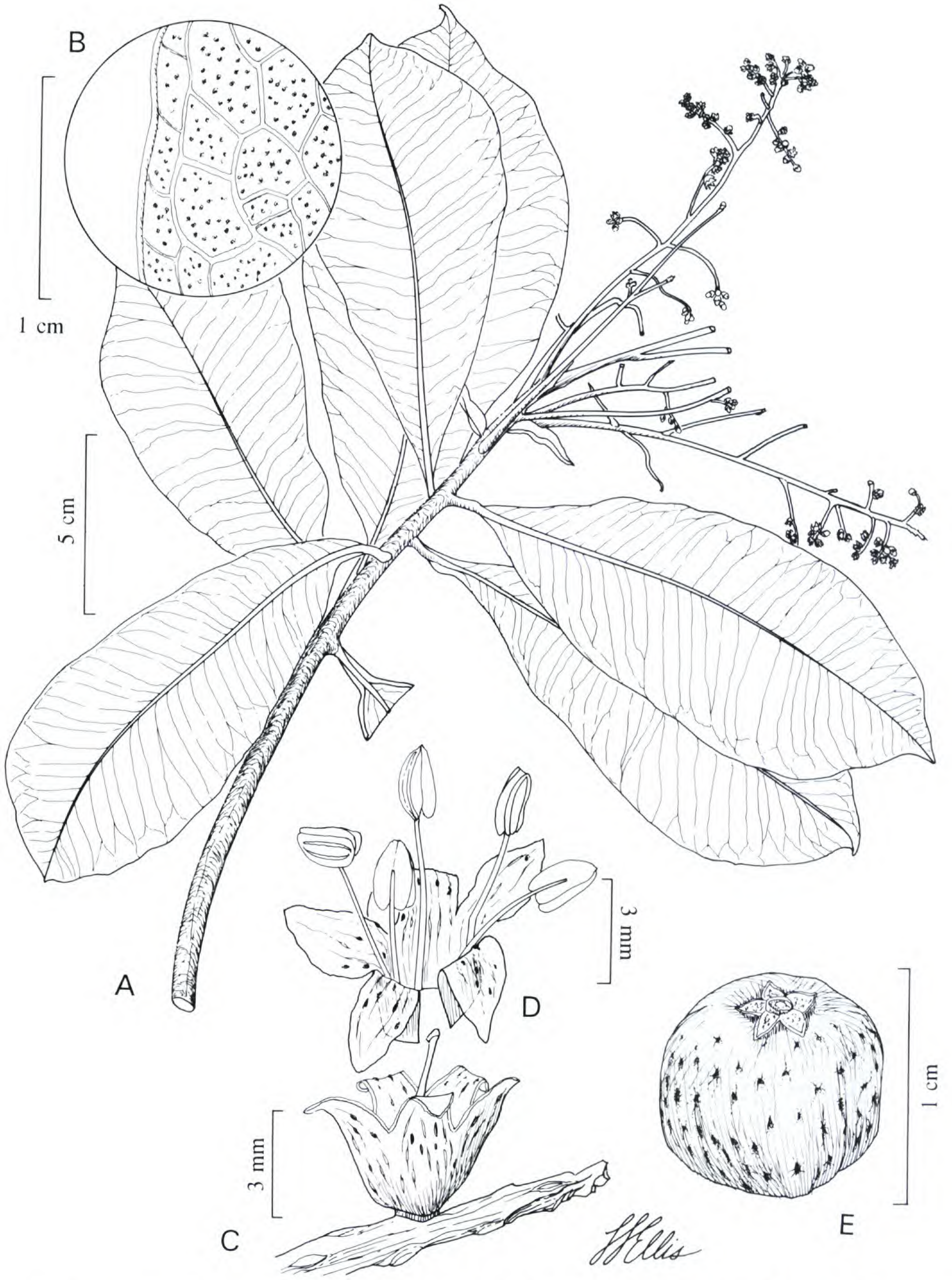

Figure 1. *Geissanthus betancurii* Pipoly. —A. Habit. —B. Detail of leaf margin. —C. Calyx. —D. Separated corolla. —E. Fruit, with calyx. A–D, drawn from the type. E, drawn from *Betancur 664*.

men 5–10 mm long, gradually tapering to an obtuse base, midrib impressed above, decurrent to petiole base, prominently raised below, secondary veins 19–29 pairs, scrobiculate and perpuncticulose above, densely ferrugineous furfuraceous-lepidote below, the scale margins overlapping and thus appearing velutinous, the margin serrate, the teeth vascularized; petioles deeply canaliculate, (2–)2.5–3 cm long, ta-

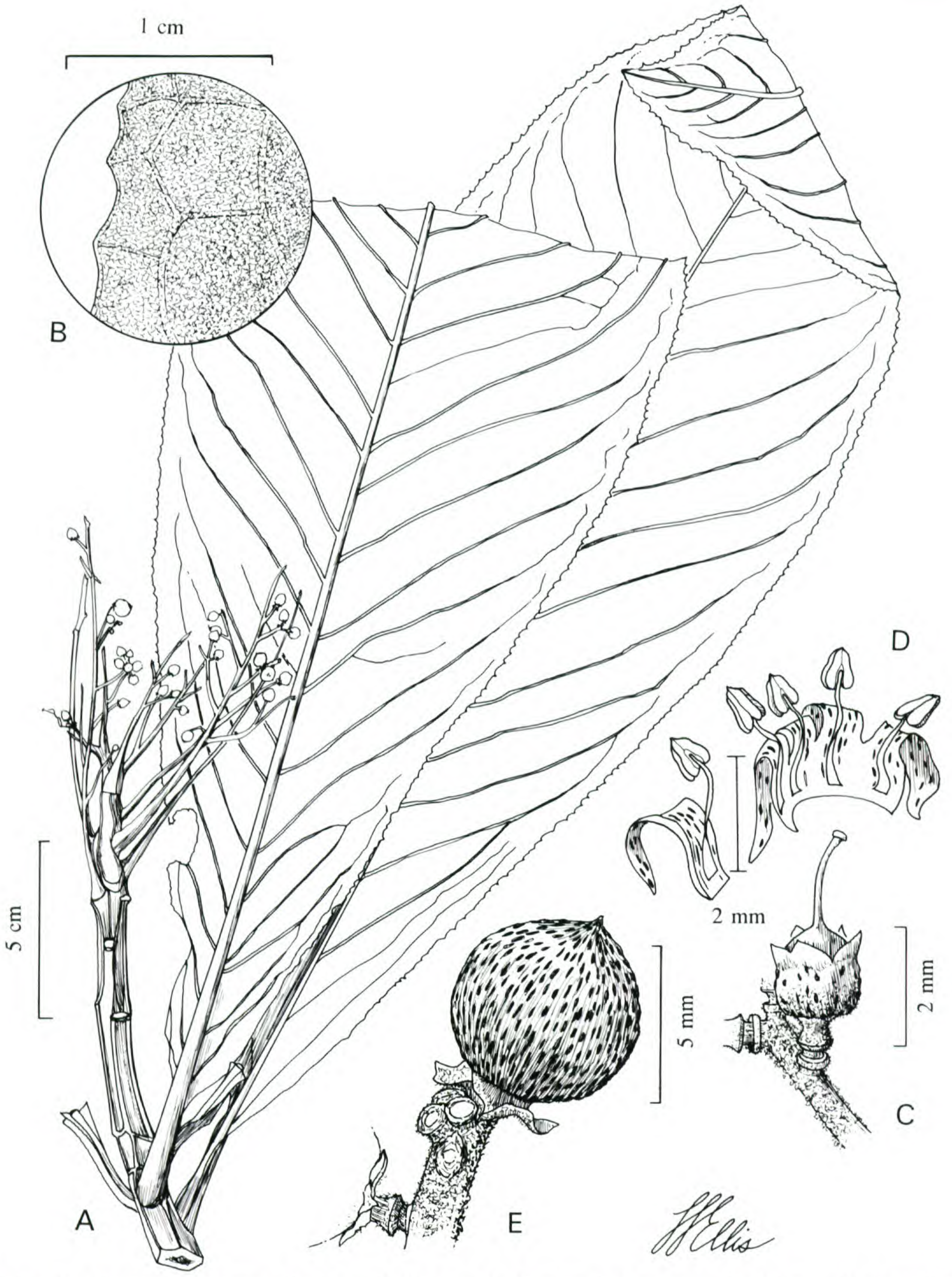

Figure 2. *Geissanthus francoae* Pipoly. —A. Habit. —B. Close up, leaf margin. —C. Calyx. —D. Separated corolla. —E. Fruit, with calyx. A, drawn from *Devia 250*. B–D, drawn from the type.

pered to the base, glabrous above, densely lepidote below, glabrescent. Inflorescence pyramidal and bipinnately paniculate, (10–)19–50 cm long, secondary branches (10–)14–25 cm long toward inflorescence base; peduncle, rachis, bracts, and pedicels densely ferrugineous furfuraceous-lepidote, the scales overlapping, persistent; inflorescence bract unknown; peduncle 3–5 mm long; primary and sec-

ondary branch bracts unknown; floral bracts membranaceous, linear, 0.4–0.6 mm long, ca. 0.1 mm wide, hyaline, apex subulate, prominently and densely black punctate, the margin entire; pedicels cylindrical, 0.4–0.8 mm long. Flowers erect, greenish white; calyx membranaceous, urceolate, the base truncate, 4–5(–6)-merous, 1.3–1.8 mm long, the tube unequally divided, 0.7–0.9 mm long, minutely glandular-papillate, the lobes erect, triangular to subdeltate, 0.6–0.9 mm long, 0.5–0.8 mm wide, apex acute to subacuminate, densely and prominently black punctate, glabrous, the margin entire, minutely glandular-ciliolate; corolla membranaceous, campanulate, 4–5-merous, 3–3.2 mm long, the tube 0.9–1 mm long, the lobes linear, 2.1–2.2 mm long, 0.6–0.7 mm wide, apex long-attenuate, reflexed 180° at anthesis, hyaline, densely and prominently black punctate and punctate-lineate, glabrous, the margin entire; stamens free, 2.1–2.2 mm long, the filaments membranaceous, flat, 1.5–1.7 mm long, hyaline, glabrous, widened basally, inserted at corolla tube base, anthers subversatile, lanceoloid, 0.9–1 mm long, 0.3–0.4 mm wide, apex emarginate, base widely subcordate, longitudinally dehiscent by wide latrorse slits, the connective hyaline, epunctate; pistil obturbinate, 2.1–2.4 mm long, the ovary 0.9–1.1 mm long and in diam., conspicuously black punctate, the style 1.1–1.2 mm long, the stigma truncate, punctiform, the placenta broadly cupuliform, ovules 4, buried in the placenta. Fruit globose, 3–5 mm long and in diam., reddish brown at maturity, densely and prominently black punctate and punctate-lineate, the exocarp thin.

Distribution. Geissanthus francoae is endemic to the western slopes of the Central and both slopes of the Western Andean Cordillera in the departments of Antioquia, Valle del Cauca, and Risaralda, Colombia, at 1,830–2,300 m elevation.

Ecology. This species is a common understory component of cloud forests in the region, growing along creek margins at the high water line. Label data from *Fonnegra et al. 3202* indicate that *Trigona* bees were observed visiting the flowers, and the flowers are very fragrant.

Etymology. It is with great pleasure that I dedicate this species to Pilar Franco, professor at the Herbario Nacional Colombiano, Instituto Nacional de Ciencias, Universidad Nacional de Colombia, colleague and specialist in Euphorbiaceae, Moraceae, and Urticaceae.

The angulate branchlets of this species, with adpressed ferrugineous furfuraceous-lepidote scales, pseudoverticillate leaves, pedicellate flowers with glandular-papillate calyces, subversatile, lanceoloid anthers and obturbinate pistil, clearly indicate a close relationship with *Geissanthus perpuncticulosus.* However, *Geissanthus francoae* is easily recognized by its chartaceous, serrate leaves with adaxial scale margins so overlapped as to form a velvety tomentum, longer petioles, membranaceous perianth, urceolate calyx, and emarginate anthers. It is interesting to note that the two apparent sister taxa are separated by habitat: *Geissanthus perpuncticulosus* occurs in premontane pluvial forests, while *G. francoae* is restricted to cloud forests.

Paratypes. COLOMBIA. **Antioquia:** Mcpio. Támesis, Vereda Río Frío, ca. 5°40′N, 75°43′W, 2,100 m, 9 Nov. 1989 (fl), *R. Fonnegra et al. 3202* (COL, JAUM, MO, US). **Valle del Cauca:** Mcpio. Versalles, Bocatoma, NW of Versalles, Finca Maribél, 2,000 m, 11 Oct. 1983 (fr), *W. Devia 250* (COL); Mcpio. Argelia, Vereda Las Brisas, 2,140 m, 21 Jan. 1983 (fr), *P. Franco et al. 1696* (COL); Mcpio. Argelia, Vereda La Bella, Finca La Miranda, 1,830 m, 25 Jan. 1983 (fr), *P. Franco et al. 1875* (COL).

Geissanthus cogolloi Pipoly, sp. nov. TYPE: Colombia. Antioquia: Mcpio. Urrao, Parque Nacional Natural "Las Orquídeas," Vereda Calles, Sector Calles, right bank of Río Calles and Quebrada "El Guaguo," 06°32′N, 76°19′W, 1,430–1,490 m, 13 Feb. 1989 (fl), *A. Cogollo, D. Cárdenas & O. Alvarez 3955* (holotype, JAUM; isotypes, COL, FMB, MO). Figure 3.

Species haec cum lamina oblonga, elliptica vel oblanceolata, asymmetrica glabraque, flores pedicellatos, calycem cupuliformem, anthera epunctata *G. lehmannii* affinis, sed ab ea laminis membranaceis (non chartaceis), secus margines integerrimis (nec crenulatis), petiolis canaliculatis (non marginatis) 1.2–1.5 (nec 0.5–0.7) cm longis, pedicellis cylindricis (non obconicis) 2.5–3 (non 1.5–2) mm longis, lobis calycinos oblongis (non ovato-triangularibus), antheris apiculatis (nec rotundatis) ad bases subcordatis (nec rotundatis) facile cognoscitur.

Shrub or small tree to 12 m × 11.5 cm DBH; branchlets terete, 2.5–3 mm diam., red-violet, nitid, densely and prominently black punctate-lineate, glabrous. Leaves alternate, membranaceous, bright red-violet in bud, the blades oblong, elliptic or rarely narrowly oblanceolate, (9.9–)12–17(–20.5) cm long, (3.2–)3.5–5(–6) cm wide, apex rostrate to long-acuminate, the acumen 0.8–1.5 cm long, base broadly obtuse, slightly asymmetric, decurrent on the petiole, midrib deeply impressed above, prominently raised and black punctate-lineate below, secondary veins 13–18, slightly raised above, prominently raised below, dark green above and light green below when fresh, nitid and glabrous above, pallid and minutely rufous translucent lepidote below, densely and prominently black punctate and

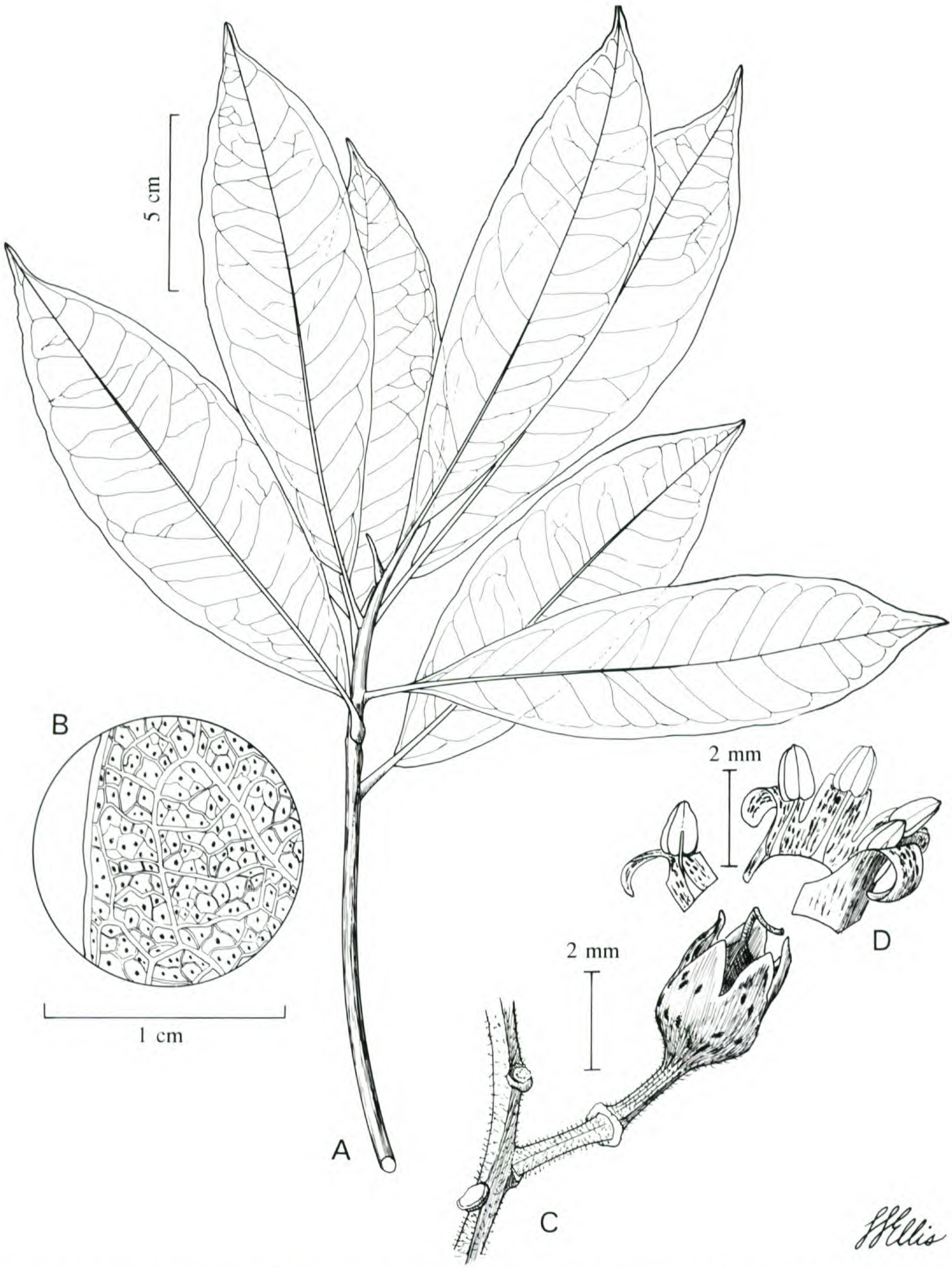

Figure 3. *Geissanthus cogolloi* Pipoly. —A. Habit. —B. Close up, leaf margin. —C. Calyx. —D. Separated corolla. A, B, drawn from *Pipoly et al. 16689*. C, D, drawn from the type.

punctate-lineate above and below, the margin hyaline, flat, entire, glabrous; petiole deeply canaliculate, 1.2–1.5 cm long, red-violet when fresh, densely and prominently black punctate and punctate-lineate, glabrous. Inflorescence terminal, pyramidal paniculate, 8–10(–28) cm long, 8–10(–15) cm wide basally, peduncle, rachis, pedicels, and calyces densely rufous glandular-papillate; inflorescence bract

unknown; peduncle 3–5(–7) mm long; secondary branch bracts membranaceous, ovate, 5–7 mm long, 3–4 mm wide, apex acute, base subtruncate, sessile, glabrous, densely and prominently black puntate and punctate-lineate, the margin entire, hyaline, glabrous; floral bract early caducous, membranaceous, linear, 2–2.2 mm long, 0.2–0.3 mm wide, apex attenuate, glabrous, densely and prominently black punctate and punctate-lineate, the margin entire, glabrous; pedicel cylindrical, 2.5–3 mm long. Flowers erect, white, 3–3.5 mm long; calyx membranaceous, deeply cupuliform, 4–5(–6)-merous, 2.3–2.5 mm long, the tube 0.5–0.8 mm long, unequally divided, the lobes oblong, 1.5–1.8 mm long, 1–1.1 mm wide, erect, apex obtuse, hyaline throughout, densely and prominently red and black punctate and punctate-lineate, sparsely rufous papillate, the margin entire, glabrous; corolla membranaceous, campanulate, 5-merous, 2.9–3.1 mm long, the tube 0.4–0.5 mm long, glabrous, the lobes oblong, 2.2–2.6 mm long, 1–1.2 mm wide, reflexed 180° at anthesis, hyaline, apex obtuse, densely and prominently red punctate and punctate-lineate, the margin entire, glabrous; stamens 5, 2.6–3.1 mm long, the filaments free, slightly expanded basally, 1.5–1.6 mm long, hyaline, epunctate, inserted at corolla tube base, the anthers subversatile, ovoid, 1.1–1.3 mm long, 0.5–0.6 mm wide, apex apiculate, base subcordate, latrorsely dehiscent by narrow longitudinal slits, the connective hyaline, epunctate; pistil obturbinate, 3.9–4.2 mm long, the ovary subglobose, 2–2.2 mm long, 1.8–1.9 mm diam., densely and prominently red punctate, glabrous, the style 1.9–2 mm long, epunctate, the stigma subcapitate, the placenta widely cupuliform, 0.7–0.9 mm long, 1.1–1.3 mm wide, the ovules 5, uniseriate, deeply immersed in the placenta. Fruit unknown.

Distribution. Endemic to Las Orquídeas National Park, western slope of the Western Andean Cordillera, Urrao Municipality, Antioquia, Colombia, 1,330–1,490 m elevation.

Ecology. *Geissanthus cogolloi* grows on steep slopes in stream canyons throughout the upper premontane forest, just above flood line. Individuals of *C. cogolloi* are found in relatively low numbers (8–10 per hectare), but are conspicuous because of the red-violet color of the terminal bud margins, branchlet apices, and petioles. The premontane forests surveyed in Parque Las Orquídeas receive approximately 6,000–8,000 mm of precipitation annually and are frequently surrounded by clouds, despite their low elevation. *Geissanthus perpuncticulosus* (Lundell) Pipoly, *Cybianthus poeppigii* Mez, and *C. venezuelanus* Mez are common elements of the same forest.

Etymology. *Geissanthus cogolloi* is named for Alvaro Cogollo Pacheco, scientific director of the Fundación Jardín Botánico, "Joaquín Antonio Uribe" (JAUM), Medellín, Colombia. He is a specialist in the systematics of Colombian Myristicaceae, and floristics of the Chocó Floristic Province.

The oblong, elliptic, or oblanceolate and glabrous leaves of *Geissanthus cogolloi*, along with its pedicellate flowers, cupuliform calyx, and epunctate anthers, indicate a close relationship with *G. lehmannii*. However, the leaf blades with membranaceous texture and entire margins, canaliculate and longer petioles, long and cylindrical pedicels, oblong corolla lobes, and anthers with an apiculate apex and subcordate base easily distinguish *Geissanthus cogolloi* from *G. lehmannii*. *Geissanthus lehmannii* is reported from an area near Popayán (Department of Cauca) and may be found in the area, but as yet has not been collected.

Paratypes. COLOMBIA. **Antioquia:** Mcpio. Urrao, Parque Nacional Natural Las Orquídeas, Quebrada Honda, 06°29′N, 76°14′W, permanent montane rainforest plot, NW of the Calles INDERENA Cabin, Plot W, subplot W2–W3, 1,340 m, 7 Dec. 1992 (ster.), *Pipoly et al. 16689* (COL, FMB, JAUM, MO); Plot W3–W4, Tree #99, 1,330 m, 8 Dec. 1992 (ster.), *Pipoly et al. 16789* (COL, FMB, JAUM, MO, US), (ster.), *Pipoly et al. 16813* (COL, FMB, JAUM, MO, US), (seedling), *Pipoly et al. 16835* (COL, FMB, JAUM, MO), 10 Dec. 1992 (ster.), *Pipoly et al. 16916* (COL, FMB, JAUM, MO, US), (ster.), *Pipoly et al. 16922* (COL, F, FMB, HUA, JAUM, MO, NY, US); Alto de Cuevas, 10 km W of Blanquita, 12 km W of Nutibara, cloud forest, 1,720 m, 3 Mar. 1992 (fl bud), *Gentry et al. 76111A* (FMB, MO).

New Combinations in *Geissanthus*

Examination of type material, concomitant with recent collections, makes the transfer of *Conomorpha scrobiculata* Cuatrecasas, *Ardisia longistaminea* A. C. Smith, and *Cybianthus perpuncticulosus* (Lundell) Pipoly & Lundell to *Geissanthus* necessary. The new combinations follow, along with revised descriptions and citation of specimens examined for the latter two species.

Geissanthus scrobiculatus (Cuatrecasas) Pipoly, comb. nov. Basionym: *Conomorpha scrobiculata* Cuatrecasas, Rev. Acad. Colomb. Ci. Ex. 8: 320. 1951. TYPE: Colombia. Valle del Cauca: costa del Pacífico, Río Yurumanguí, El Papayo, 5 Feb. 1944 (fl, fr), *J. Cuatrecasas 15998* (holotype, F; isotype, COL).

This species is known only from the type, but the calyx development, corolla lobe shape, and anther morphology clearly place this species in *Geissanthus*.

Geissanthus longistamineus (A. C. Smith) Pipoly, comb. nov. Basionym: *Ardisia longistaminea* A. C. Smith, Amer. J. Bot. 27: 544. 1940. TYPE: Colombia. Nariño: Gorgonilla Island, 130–200 m, 9 Feb. 1939 (fl), *E. Killip & H. García 33078* (holotype, NY; isotype, US).

Shrub or small tree to 10 m tall; branchlets terete, except angular at apex, 5–8 mm diam., sparsely and minutely rufous glandular-granulose and furfuraceous-lepidote, glabrescent. Leaves pseudoverticillate, chartaceous, the blades narrowly to widely oblanceolate, (15–)19–31(–42.5) cm long, (4–)8–12.5 cm wide, apex acuminate, the acumen (0.7–)1–1.5(–2.2) cm long, base abruptly truncate, midrib impressed above, prominently raised below, the secondary veins 15–23 pairs, smooth or somewhat impressed above, prominently raised and prominently black punctate-lineate below, blades smooth and glabrous above, moderately and minutely furfuraceous-lepidote and black punctate-lineate below, the margin flat, entire, glabrous; petiole canaliculate, (1–)1.5–2.5(–3) cm long, tapered to base, glabrous above, densely and minutely furfuraceous-lepidote below, glabrescent. Inflorescence terminal, pyramidal and bipinnately paniculate, 10–16 cm long, secondary branches 4–6 cm long at base, peduncle, rachis, bracts, and pedicels densely glandular-granulose, glabrescent; inflorescence bract unknown; peduncle obsolete to 3 mm long; primary and secondary branch bracts unknown; floral bracts membranous, linear-lanceolate, 3.2–3.5 mm long, 1–1.1 mm wide, apex attenuate, asymmetric, sparsely and prominently red punctate, the margin hyaline, irregular, with occasional serrulations apically, glabrous; pedicel obconic, 0.2–1.3 mm long, densely glandular-granulose. Flowers erect, 5.8–6.3 mm long; calyx membranaceous, campanulate, whitish, 4–5-merous, 3.4–4 mm long, the tube 1.3–1.5 mm long, unequally divided, the lobes ovate to widely oblong, 2.1–2.5 mm long, 1.5–2 mm wide, apex obtuse, medially thickened, densely and prominently brown punctate, and punctate-lineate, densely glandular-granulose, the margin hyaline, irregular, with occasional papillae, entire, glabrous; corolla membranaceous, starting out tubular, then the lobes opening to become somewhat campanulate, 5.5–5.7 mm long, pinkish cream; early ontogeny: the tube unequally divided, 4.5–5 mm long, the lobes trullate, ca. 0.5–1 mm long, 1–1.1 mm wide, apex acute, erect, hyaline, densely and prominently brown punctate and punctate-lineate, the margin entire, glabrous; corolla at maturity: tube unequally divided, ca. 2 mm long, the lobes linear, 3.5–3.7 mm long, 1–1.4 mm wide, reflexed 180° from tube, hyaline, and as described above; stamens free, 5–5.7 mm long, subequaling the petals, the filaments membranaceous, terete, 4–4.5 mm long, not basally widened, inserted at the base of the corolla tube, the anthers oblongoid, 2.2–2.4 mm long, 0.6–0.8 mm wide, apex obtuse, base deeply cordate, versatile, dehiscent by wide latrorse longitudinal slits, the connective epunctate, hyaline; pistil obturbinate, 3–4 mm long, the ovary 1.2–1.5 mm long, 1–1.1 mm diam., densely and prominently red punctate, sparsely glandular-granulose, the style 1.7–2 mm long, erect, epunctate, the stigma ca. 0.2–0.3 mm long, the placenta depressed-conical, ca. 0.2–0.3 mm long, 0.4–0.5 mm diam., the ovules 5, uniseriate, deeply imbedded in the placenta. Fruit globose, 6–8 mm long and in diam., densely and prominently black punctate and punctate-lineate, exocarp thin.

Distribution. Endemic to the Chocó Floristic Province of Colombia and Ecuador, from 80 to 1,150 m elevation.

Ecology. Geissanthus longistamineus is a ridgetop species, occurring at margins of primary forest habitats.

Common name. "Capulí."

Specimens examined. COLOMBIA. **Chocó:** Quibdó–Tutunendo Rd., ca. 3 km W of Tutunendo, 05°46′N, 76°35′W, 80 m, 8 Jan. 1981 (ster.), *A. Gentry et al. 30346* (COL, MO). **Nariño:** Mcpio. de Barbacoas, between Barbacoas and 15 km above Río Telembí, toward Chalchal, 01°40′N, 78°09′W, 170 m, 20 Nov. 1986 (fl), *B. Hammel & R. Bernal 15772* (COL, HUA, MO, US); Barbacoas, Corregimiento Santander, Buenavista to Barbacoas, slopes toward Río Telembí, 200–840 m, 3–5 Aug. 1948 (fl bud), *H. García-Barriga 13190* (COL); Tumaco, near Piñal Dulce, 7 Oct. 1955 (fr), *R. Romero-Castañeda 5342* (COL, MO). ECUADOR. **Cotopaxi:** Tenefuerste, Río Pilalo, km 52–53 Quevedo–Latacunga, 750–900 m, 19 July 1992 (fl), *C. Dodson et al. 13462* (MO, QCA, SEL). **Esmeraldas:** Río Cayapa, Zapallo Grande, 1 km upriver from village, 78°55′W, 0°48′N, 150 m, 3 Aug. 1982 (fr), *L. Kvist & E. Asanza* (AAU, QCA); San Lorenzo, Finca la Chiquita, 01°13′N, 78°49′W, 80 m, 8–15 July 1988 (fl bud), *W. Palacios 2652* (MO, QCNE, US). **Los Ríos:** Río Palenque Biological Station, km 56 Quevedo–Sto. Domingo, 150–220 m, 18 Mar. 1974 (fl), *C. Dodson et al. 5506* (MO, QCA, RPSC, SEL), 11 Aug. 1977 (fr), *C. Dodson et al. 6731* (MO, QCA, RPSC, SEL), 200 m, 6 Feb. 1974 (ster.), *A. Gentry 9684* (MO, RPSC, SEL), 27 Feb. 1974 (fl bud), *A. Gentry 10220* (MO, RPS, SEL), 79°25′W, 00°35′S, 150 m, 19 June 1991 (fr), *W. Palacios & E. Freire 7404* (MO, QCNE); ridge line at El Centinela Ila, on rd. from Patricia Pilar to 24 de Mayo, km 45 on rd. Sto. Domingo to

Quevedo, 600 m, 23 May 1983 (fr), *C. Dodson & A. Gentry 13822* (MO, SEL, RPSC), 650 m, 26 July 1984 (fr), *C. Dodson et al. 14505* (MO, SEL, RPSC). **Manabí:** Mahcalilla National Park, zona de San Sebastián, 01°36′S, 80°42′W, 20 Jan. 1991 (fl), *A. Gentry & C. Josse 72740* (MO, QCNE). **Napo:** Huamaní, Centro Calluhua Yacu, 31 km E of Tena–Baeza Rd., on new rd. to Coca, 0°40′S, 77°40′W, 1,150 m, 24 Dec. 1988 (ster.), *Gentry et al. 64134* (MO, QCNE).

Geissanthus longistamineus is a relatively well known member of the genus, especially from the fine gatherings noted above from Ecuador. It appears to have an as yet undescribed sister species from Pasco, Peru, but is immediately distinguished from that and all others by its corolla, which is at first tubular, then splits into long lobes, with obtrullate lobules differentiated at the lobe apices. This unique character allows for rapid recognition in flower, and in fruit the taxon may be recognized by the spreading, but not recurved, calyx lobes and relatively large fruits.

Geissanthus perpuncticulosus (Lundell) Pipoly, comb. nov. Basionym: *Ardisia perpuncticulosa* Lundell, Wrightia 5(6): 194. 1975. *Cybianthus perpuncticulosus* (Lundell) Pipoly & Lundell, Wrightia 7(2): 52. 1982. TYPE: Panama. Darién: vic. of Cerro Tacaracuna, summit camp, along N stream of camp, 1 Feb. 1975 (fr), *A. Gentry & S. Mori 14049* (holotype, LL-TEX; isotypes, MO—2 sheets).

Shrub or small tree to 15 m tall; branchlets angulate, (4.5–)6–8 mm diam., densely furfuraceous-lepidote, glabrescent. Leaves pseudoverticillate, membranaceous, the blades obovate to oblanceolate, or rarely elliptic, (13.5–)16–28(–44.5) cm long, (6–)8–12(–18.5) cm wide, apex subacuminate to long-acuminate, the acumen 0.5–1.5 cm long, base broadly cuneate, decurrent on the petiole, midrib impressed and glabrous above, prominently raised and densely furfuraceous-lepidote below, secondary veins 16–27 pairs, somewhat impressed and glabrous above, prominently raised and densely furfuraceous-lepidote below, densely and minutely scrobiculate and black perpuncticulose above, prominently black punctate and sparsely furfuraceous-lepidote below, the margin flat, entire, glabrous; petioles canaliculate, 1–1.5 cm long, glabrous above, densely furfuraceous-lepidote, glabrescent. Inflorescence a terminal or rarely (*E. Forero et al. 6869*) axillary pyramidal bipinnate panicle, (8–)13–18(–27) cm long, (11.5–)13–23(–34.5) cm wide at base, inflorescence bract membranaceous, foliaceous, oblanceolate, 4.8–5 cm long, 1.3–1.5 cm wide, apex long-acuminate, the acumen 0.3–0.5 cm long, base cuneate, sparsely fufuraceous above and below except along midrib and secondary veins, midrib impressed above, prominently raised below, secondary veins 13–15 pairs, scrobiculate and densely black perpuncticulose above, prominently black punctate below, the margin flat, entire, glabrous, caducous, the bract petiole canaliculate, ca. 0.5 cm long, glabrous above, densely furfuraceous-lepidote below; peduncle, rachis, secondary branches and pedicels densely and minutely furfuraceous-lepidote; peduncle obsolete to 1 cm long; secondary branch bracts membranaceous, oblanceolate, 0.3–0.5 mm long, ca. 0.1–0.2 mm wide, apex acuminate, base cuneate, furfuraceous-lepidote and densely and prominently black punctate above and below, the margin flat, entire, glabrous; floral bracts membranaceous, linear-lanceolate, 1–1.5 mm long, 0.2–0.3 mm wide, apex long-attenuate, prominently black punctate, translucent glandular-lepidote and glandular-papillate, the margin irregular, entire; pedicels cylindrical, 0.9–1.5 mm long, densely translucent glandular-lepidote and glandular-papillate. Flowers erect, white; calyx chartaceous, cupuliform, 4–5(–6)-merous, 1.2–1.7 mm long, the tube 0.6–0.7 mm long, very unequally divided, the lobes widely ovate to linear, 0.9–1.1 mm long, 0.4–1.1 mm wide, apex obtuse, densely and prominently orange punctate, minutely red glandular-papillate, the margin apically erose, hyaline, glabrous; corolla chartaceous, campanulate, 2.4–2.7 mm long, the tube 0.3–0.5 mm long, the lobes linear-lanceolate, 2.1–2.3 mm long, 0.3–0.4 mm wide, reflexed 180° at anthesis, apex attenuate, densely and prominently orange punctate, glabrous, the margin entire, glabrous; stamens free, 1.7–2 mm long, the filaments membranaceous, flat, 1.4–1.7 mm long, widened basally, inserted at corolla tube base, anthers subversatile, lanceoloid, 0.7–0.8 mm long, 0.2–0.3 mm wide, apex obtuse, base cordate, longitudinally dehiscent by narrow, latrorse, longitudinal slits, the connective hyaline, epunctate; pistil obturbinate, 1.4–1.7 mm long, the ovary 0.7–0.8 mm long, 0.3–0.4 mm diam., densely and prominently red punctate, glabrous, the style 0.6–0.7 mm long, curved, the stigma capitate, the placenta globose, 0.5–0.6 mm long, 0.2–0.3 mm diam., ovules 4, buried in the placenta. Fruit globose, 3.5–4 mm long and in diam., densely and prominently black punctate and punctate-lineate, the exocarp thin, reddish purple at maturity.

Distribution. Endemic to the Chocó Floristic Province, Panama (Darién) and Colombia (Antioquia, Chocó), at 100–1,400 m.

Ecology. Geissanthus perpuncticulosus grows in ravines on gravel islands in creekbeds, where fre-

quent flash floods occur with onset of heavy rains. Thus far it is known from tall pluvial and premontane pluvial forests, in areas that receive ca. 8,000 mm annual precipitation.

Etymology. The specific epithet refers to the numerous small punctations that adorn the leaves of this species.

Lundell (1975) described this species in *Ardisia* because of its furfuraceous-lepidote tomentum, but indicated its generic position was uncertain, and furthermore, that it might belong to *Gentlea* Lundell. The type specimen is in late fruit and the regularity in merosity of the remaining fruits on it indicated that *Cybianthus* subg. *Weigeltia* (A. DC.) Agostini was in order, so Pipoly and Lundell transferred it (Pipoly & Lundell, 1982). However, with additional material, close examination of the inflorescence vestiture, the campanulate corolla, linear petals, free filaments, and subversatile, latrorsely dehiscent anthers, placement in *Geissanthus* was indicated.

Geissanthus perpuncticulosus is most closely related to *G. francoae*, but is easily distinguished from that taxon by its membranaceous leaves, sparsely placed abaxial lepidote scales, shorter petioles, chartaceous perianth, cupuliform calyx, shorter corolla, obtuse anthers, and premontane forest habitat.

Specimens examined. COLOMBIA. **Antioquia:** Mcpio. de Urrao, Vereda Calles, Parque Nacional Natural "Las Orquídeas," sector Cabaña de Calles, Quebrada Agudelo, 06°31′N, 76°19′W, 1,300–1,400 m, 1 Apr. 1992 (fl, fr), *D. Cardenas et al. 3209* (COL, FMB, JAUM, MO); Quebrada Honda, range NW of Cabaña de Calles, Plot W, 06°29′N, 76°14′W, 1,330 m, 8 Dec. 1992 (ster.), *Pipoly et al. 16813* (COL, FMB, JAUM, MO). **Chocó:** Mcpio. San José del Palmar, bank of Río Torito, tributary of Río Hábita, W slopes, Finca Los Guaduales, 630–730 m, 8 Mar. 1980 (fl, fr), *E. Forero et al. 6869* (COL, MO), W slopes, 630–680 m, 10 Mar. 1980 (fr), *E. Forero et al. 6961* (COL, MO), E slopes, 630 m, 21 Mar. 1980 (fl bud), *E. Forero et al. 7554* (COL, MO), 21 Mar. 1980 (fr), *E. Forero et al. 7565* (COL, MO); Río Mutatá, tributary of Río El Valle, between base of Alto del Buey and river mouth, 100–150 m, 9 Aug. 1976 (fr), *A. Gentry & M. Fallen 17452* (AAU, COL, LL-TEX, MO).

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A New *Xylopia* (Annonaceae) from Panama

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ABSTRACT. *Xylopia panamensis* sp. nov. is proposed based on material from Santa Rita Ridge and El Llano–Cartí road formerly referred to *Xylopia bocatorena* Schery. The new species differs from *X. bocatorena* by its rounded leaf base, longer indument on the bracts and calyx, smaller flowers, fewer seeds per monocarp, and thus shorter monocarps.

Reexamination of Mesoamerican material of *Xylopia* in conjunction with the preparation of a treatment of the Annonaceae for the *Manual to the Plants of Costa Rica* has revealed a previously undescribed species from Colón and San Blas Provinces, Panama.

Xylopia panamensis G. E. Schatz, sp. nov. TYPE: Panama. San Blas: El Llano–Cartí road, km 26.5, 9°19′N, 78°55′W, 200 m, 17 June 1986 (fl, fr), *de Nevers, Herrera, McPherson, D'Arcy & Allen 7836* (holotype, MO; isotypes, PMA not seen, U). Figure 1.

Ab *Xylopia bocatorena* laminis basi rotundatis, bracteis ut calyces dense aureosericeis, pilis ad 2 mm longis, floribus minoribus, semenibus paucioribus, monocarpiis brevioribus differt.

Tree 4–14 m tall, the young branches initially sparsely covered with short, spreading hairs, at length glabrescent. Petiole slender, 2–6 mm long, sparsely covered with short, spreading hairs; lamina chartaceous to slightly membranaceous, broadly lanceolate to narrowly ovate, 5.5–12.5 cm long, 1.7–5.2 cm broad, the apex long acuminate to cuspidate, the acumen 1–2 cm long, the base rounded to truncate, rarely obtuse, the upper surface glabrous, the lower surface sparsely covered with appressed, white hairs to 1.5 mm long; venation very weakly brochidodromous with 6–10 faint secondary veins per side, the primary vein even with the lamina surface adaxially, somewhat elevated and sparsely covered with appressed, white hairs to 1.5 mm long abaxially. Flowers solitary, axillary. Pedicel 2–4 mm long, borne in the axil of a basal round bracteole and bearing 1–2 additional distichous, broadly ovate amplexicaul bracts, 5 mm long and broad, the apex acute, densely long golden sericeous, the hairs to 2 mm long. Sepals 3, connate at the base for ½ their length, broadly ovate, 6–9 mm long, the lobes 5–8 mm broad, the apex acute, densely long golden sericeous outside, the hairs to 2 mm long, glabrous inside. Petals 6, in 2 valvate whorls, fleshy, white; outer petals ovate to narrowly elliptic, strongly concave, 7 mm long, 4–5 mm broad, 1 mm thick, the apex acute, the base obtuse, densely short white sericeous outside, very short tomentellous inside, with a medial keel inside toward the apex marking the line along which adjacent inner petals meet; inner petals rhombic-trullate, 5 mm long, 3 mm broad, 0.5 mm thick, the apex acute, the base cuneate, strongly concave where the petal fits tightly against the androecium, densely short white sericeous outside, glabrous inside. Torus conical, 3.2 mm diam., with a central cavity into which the ovaries are embedded. Stamens ca. 200 (based on scars from the filament bases on the torus), stamens lacking; carpels 3–8 (based on fruiting monocarps present), ovaries lacking. Fruit a cluster of separate stipitate dehiscent monocarps, the stipe 2–3 mm long, the monocarp shortly cylindric to ellipsoid, to 3 cm long, 1.5 cm diam., the apex strongly apiculate, and with 1 to several additional beaklike protuberances along the margin of dehiscence, the surface initially densely sericeous, at length puberulent, red; seeds 2–3, interdigitated to form a single row, flattened ellipsoid, 10 mm long, 6 mm diam., shiny black with a fleshy, bilobed, white aril at the base.

Much of the material cited has previously been determined as *Xylopia bocatorena* Schery, to which the new species, *X. panamensis*, is undoubtedly closely related, and with which it is wholly sympatric. In several respects—leaf length and seed number (and therefore, monocarp length)—the new species conforms well to the original description of *X. bocatorena* (in Woodson & Schery, 1943). However, as numerous collections of *X. bocatorena* have accumulated from Nicaragua to El Llano–Cartí Road in Panama, these two features of the type material (*von Wedel 2965* (HT: MO)) from Bocas del Toro, Panama, have proven anomalous. Leaves on the type fall within the lower end of the overall range in variation of leaf length; indeed, *X. bocatorena* often displays leaves considerably longer (to 22 cm)

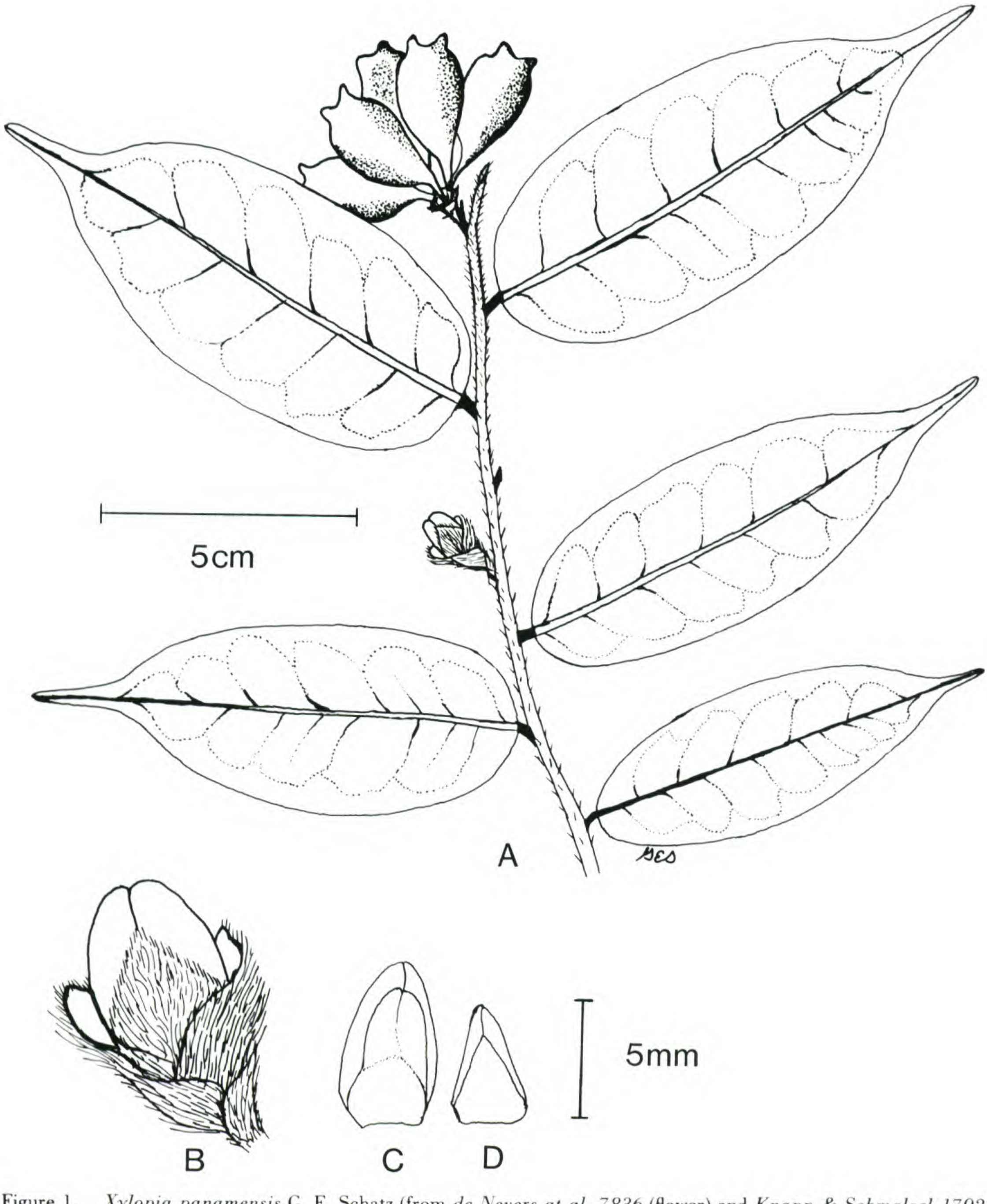

Figure 1. *Xylopia panamensis* G. E. Schatz (from *de Nevers at al. 7836* (flower) and *Knapp & Schmalzel 1792* (fruit)). —A. Composite flowering and fruiting branch. —B. Flower with subtending bracts. —C. Adaxial view of outer petal. —D. Adaxial view of inner petal.

than those on the type (8–11 cm). Similarly, the number of seeds (2), and hence, minimum number of ovules, described from the type is unusually low, resulting in a concomitantly short monocarp (2 cm). Usually, ca. 6 ovules are present (to 10), resulting in a cylindrical monocarp 5 cm long. Thus, in general *X. panamensis* can be characterized by fewer seeds, resulting in a shorter, more flattened ellipsoid monocarp, which, moreover, has one to several curious beaklike appendages along the margin of dehiscence, which are lacking on monocarps of *X. bocatorena*.

Xylopia panamensis differs further from *X. bocatorena* by a more rounded versus cuneate to ob-

tuse leaf base, generally smaller flowers, and especially by the markedly longer (to 2 mm long vs. less than 0.5 mm long) golden sericeous indument on the bracts and calyx. Among several other northern South American species of *Xylopia* with solitary, relatively large flowers, *X. panamensis* also exhibits affinities with *X. chocoensis* R. E. Fries in the size and shape of the monocarps and a rounded leaf base (Fries, 1955). However, leaves of *X. chocoensis* are nearly always longer (12–15 cm long), and the number of carpels (ca. 25) is significantly greater.

Paratypes. PANAMA. **Colón:** Santa Rita E Ridge, 23 Jan. 1968 (fr), *Dwyer 8421* (MO), 300–500 m, 16 Dec. 1972 (fr), *Gentry 6571* (MO), 21 km from Transisthmian Hwy., 9°26′N, 79°38′W, 400–500 m, 23 Oct. 1981 (fr), *Knapp & Schmalzel 1792* (MO, U), ca. 4–5.5 mi. E of Transisthmian Hwy., 6 Apr. 1969 (fl, fr), *Lewis et al. 5275* (MO), 20–25 km from Transisthmian Hwy., 9°24′N, 79°39′W, 30–400 m, 25 Sep. 1980 (fr), *Sytsma 1354* (MO), 10 Oct. 1980 (fr), *Sytsma 1526* (MO), ca. 3.1 km E of Agua Clara rain gauge, 9 Sep. 1975 (fr), *Witherspoon et al. 8316* (MO).

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Terpsichore, a New Genus of Grammitidaceae (Pteridophyta)

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ABSTRACT. *Terpsichore*, a new genus of Grammitidaceae, is described and combinations are made for the species known to belong to it. *Terpsichore* differs from other genera in the family by the combination of the following characters: the presence of usually conspicuous hydathodes that sometimes produce calcareous secretions; reddish to atropurpureous (less often hyaline) setae mostly 1–3 mm along the stipe, rachis, costae, and (sometimes) lamina; nonclathrate, usually castaneous to blackish rhizome scales that are usually setulose along the margins; and free, unbranched, pinnate venation in the segments of pinnae. The genus comprises about 50 species and is primarily neotropical; one species is known from Africa and offshore islands. A key is provided to distinguish the neotropical genera of Grammitidaceae.

This is the last in a series of papers describing new genera of neotropical Grammitidaceae. Earlier papers dealt with the anhydathodous genera *Ceradenia* (Bishop, 1988), *Zygophlebia* (Bishop, 1989), and *Enterosora* (Bishop & Smith, 1992), while more recently the hydathode-bearing genera *Lellingeria* (Smith et al., 1991), *Melpomene* (Smith & Moran, 1992), and *Micropolypodium* (Smith, 1992) have been delimited. Species of *Terpsichore* also have hydathodes, sometimes with calcareous secretions. There are approximately 50 known species, making it about equal in size to *Lellingeria* and *Ceradenia*.

The distinctness of *Terpsichore*, named for the Greek muse of dance, was first realized by the late L. Earl Bishop. Unfortunately, he was unable to advance the work beyond the use of the name in labeling some of his own collections. I have made a search of herbaria (UC and MO), recent floristic accounts for Latin American countries (Proctor, 1977, 1985, 1989; Stolze, 1981; Mickel & Beitel, 1988; Lellinger, 1989), Copeland's monograph of *Ctenopteris* (1956), and other relevant literature to determine those species that should be transferred to the new genus.

The following artificial key is provided to distinguish *Terpsichore* from its New World congeners:

ARTIFICIAL KEY TO GENERA OF NEOTROPICAL GRAMMITIDACEAE

1. Laminae entire or with margin slightly repand, rarely 1–2-forked with divisions entire 2
1. Laminae shallowly to deeply lobed to pinnatifid or 1-pinnate, rarely pinnate-pinnatifid 8
2(1). Veins connected by a marginal vascular strand, thus forming a row of areoles along each side of midrib; Greater Antilles .... *Lomaphlebia*
2. Veins free, or only casually and infrequently anastomosing; widespread in the Neotropics 3
3(2). Sori intermixed with whitish, stipitate, spherical glands .... *Ceradenia jungermannioides* (Klotzsch) L. E. Bishop
3. Sori lacking glands, or glands, if present, not whitish 4
4(3). Laminae with a dark brown to black sclerenchymatous border .... *Grammitis* sect. *Grammitis*
4. Laminae lacking a strongly differentiated dark border 5
5(4). Stipes and laminae with numerous dark setae greater than 1 mm 6
5. Stipes and laminae lacking dark setae, or if such setae present then these usually few and less than 1 mm 7
6(5). Rhizomes short-creeping; sori round or nearly so; tropical America ..... *Enterosora*
6. Rhizomes long-creeping; sori oblong to short-linear; southern Chile and Argentina ... . *Grammitis patagonica* (C. Christensen) Parris
7(5). Hydathodes present; tropical America .. .. *Cochlidium*
7. Hydathodes usually absent (sometimes present in *G. magellanica* Desvaux); southern Chile and Argentina ....*Grammitis* sect. *Grammitastrum*
8(1). Hydathodes absent or obscure on adaxial surface of lamina 9
8. Hydathodes present at the ends of veins on adaxial surface of the laminae 12
9(8). Laminae simple, a single blade differentiated into serrate, sterile, proximal part and an entire, usually fertile, distal part .... *Cochlidium serrulatum* (Swartz) L. E. Bishop
9. Laminae sinuate, shallowly lobed, or more often pinnatifid to pinnate (rarely more divided), not differentiated into distinct sterile and fertile parts 10

10(9). Sori with conspicuous, whitish, spherical, waxlike paraphyses (most easily seen in young fronds); veins free ..... *Ceradenia*
10. Sori lacking evident waxlike, spherical paraphyses, or if paraphyses evident these brownish and not waxlike; veins often anastomosing to form regular or irregular areoles 11
11(10). Laminae sinuate, or lobed no more than ¾ the distance to the midrib ..... *Enterosora*
11. Laminae deeply pinnatifid or pinnatisect nearly to the midrib ..... *Zygophlebia*
12(8). Scales of rhizomes lacking setulae (often bearing papillate glands less than 0.1 mm at tip), strongly clathrate, often iridescent; rhizomes long-to short-creeping, strongly dorsiventral ..... *Melpomene*
12. Scales of rhizomes setulose or not, not clathrate, or if clathrate, then setulose; rhizomes generally short-creeping to suberect, radial or weakly dorsiventral, rarely strongly dorsiventral 13
13(12). Main vein (costa) in the segments (or pinnae) simple (lacking branches) or with a single acroscopic veinlet; sori only one per segment or pinna; laminae narrowly linear, usually less than 1 cm wide; rhizomes radially symmetric 14
13. Main vein (costa) in the segments (or pinnae) with more than 1 branch; sori usually more than one per segment or pinna; laminae usually lanceolate to ovate, usually more than 1 cm wide; rhizomes radially to dorsiventrally symmetric 15
14(13). Rhizome scales golden to orangish or light brownish, not clathrate; castaneous or red-brown simple (unforked) setae more than 1 mm long generally present on midribs and sometimes on lamina . *Micropolypodium*
14. Rhizome scales dark brown to blackish, clathrate; castaneous or red-brown setae generally lacking on midribs and lamina, if present then less than 0.5 mm long and often unequally forked ..... *Lellingeria*
15(13). Scales clathrate; sori often slightly to deeply immersed in the lamina; stipes and rachises with hyaline to light reddish setulae 0.1–0.3 mm, lacking dark setae; rhizomes ascending, radially symmetric ... *Lellingeria*
15. Scales not clathrate; sori superficial; stipes and rachises generally with dark setae more than 0.5 mm; rhizomes short-creeping to ascending, dorsiventral to radial . *Terpsichore*

Terpsichore A. R. Smith, gen. nov. TYPE: *Polypodium asplenifolium* L., Sp. Pl. 2: 1084. 1753. ≡ *Terpsichore asplenifolia* (L.) A. R. Smith. Figure 1.

Plantae plerumque epiphyticae; rhizomata infirme dorsiventralia vel radialia; squamae rhizomatis non clathratae, plerumque brunneolae, atropurpureae, vel nigrescentes, concolores, margine plerumque setulosae; folia plerumque pinnatisecta, cum hydathodis adaxialiter, interdum exsudatis calcareis efferentibus; laminae interdum fungis ateris clavatis praeditae; petioli et rhachides setosi, setis castaneis vel atropurpureis, interdum albidis; venae librae non furcatae; sori rotundi superficales, sine glandibus.

Plants epiphytic, rarely saxicolous or terrestrial; rhizomes short-creeping to ascending, generally weakly dorsiventral to radial, the scales nonclathrate, brown to blackish, infrequently orangish, concolorous, dull to usually shining, glabrous or with variously colored (hyaline to castaneous) setae; phyllopodia present or absent; petioles nearly absent to equaling the lamina, setose (especially proximally) and sometimes also puberulent, the setae 0.5–3 mm, usually reddish or castaneous, numerous, spreading, the hairs 0.1–0.2 mm, branched or unbranched, pale reddish, sometimes glandular; laminae pinnatisect to 1-pinnate, rarely 1-pinnate-pinnatifid, forking in a few spp., monomorphous, usually setose (at least along the rachis); hydathodes present, sometimes producing calcareous secretions (whitish lime-dots); veins simple, pinnate from the costae, free, hidden or easily visible; sori round, not sunken into the lamina, without paraphyses; sporangial capsules glabrous or setose; spores globose-tetrahedral, oblate, or reniform, with a trilete or monolete laesura. $x = 37$.

Distribution. Terpsichore comprises about 50 neotropical species, with one, *T. cultrata*, extending into Africa (Schelpe, 1969), Madagascar (Tardieu-Blot, 1960), and the Mascarenes.

It is uncertain whether African material called *T. cultrata* is really conspecific with New World material of the same species, but if not, plants from the two areas are certainly closely allied. It is highly interesting, and suggestive of antiquity for the Grammitidaceae, that most of the genera of neotropical Grammitidaceae, including *Terpsichore*, *Ceradenia*, *Enterosora*, *Lellingeria*, *Melpomene*, *Zygophlebia*, *Grammitis* sensu stricto, and *Cochlidium*, are also represented by one or a few species in Africa and islands of the Indian Ocean (Smith, 1993); these same genera, with the exception of *Lellingeria* and *Grammitis*, are absent from southeast Asia and the Pacific.

Characters defining *Terpsichore* include the presence of rather conspicuous hydathodes on the adaxial surface of the laminae; castaneous or atropurpureous to whitish setae along the stipe, rachis, costae, and sometimes lamina; setae usually dense at the stipe bases, absence of glandular paraphyses in the sori; nonclathrate, usually castaneous or atropurpureous (occasionally blackish or orangish), concolorous rhizome scales that are usually setulose along the margins, or at least at the tip, and sometimes on the surfaces; rhizomes generally weakly dorsiventral to radial in symmetry; and free, un-

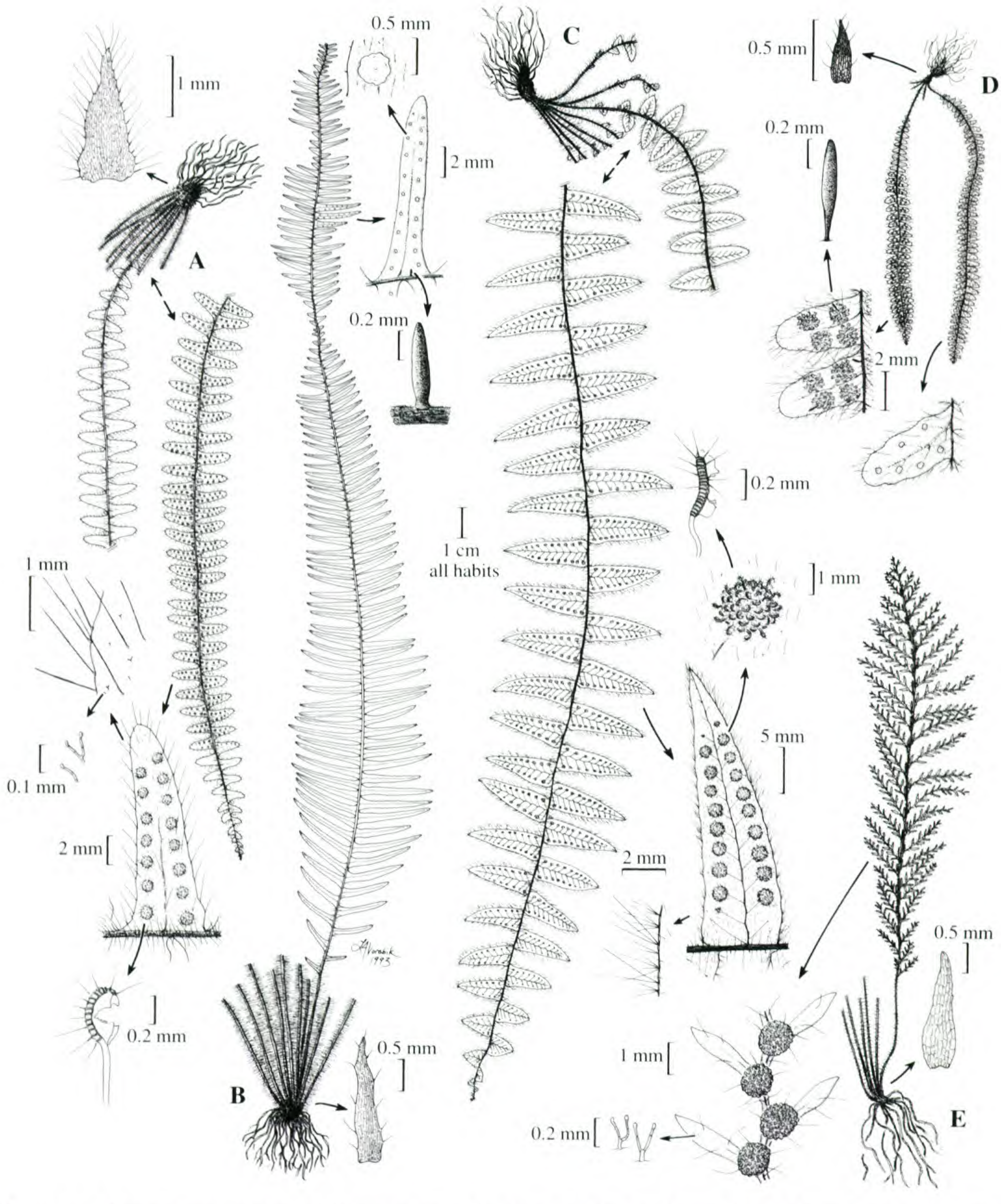

Figure 1. Characteristic species of *Terpsichore*. —A. *T. alsophilicola*, Group 1, habit (pendent, indeterminate epiphyte) and details to show rhizome scale, abaxial surface of segment, indument, and sporangium (*Knapp & Kress 4315*, UC). —B. *T. alsopteris*, Group 2, habit (erect-arching) and details to show rhizome scale, fungal fruiting body from rachis, and calcareous secretions from hydathodes on adaxial surface (*van der Werff & Palacios 10589*, UC). —C. *T. longa*, Group 3, habit (pendent indeterminate epiphyte) and details to show sporangia, paired and clustered setae on pinna margin (*van der Werff et al. 9488*, UC). —D. *T. subtilis*, Group 4, habit (arching-pendent) and details to show rhizome scale, abaxial surface of segments, fungal fruiting body in sorus, and calcareous secretion from hydathodes on adaxial surface (*van der Werff & Palacios 9147*, UC). —E. *T. longisetosa*, Group 5, habit (± erect) and details to show rhizome scale, abaxial surface of segments, and branched laminar hairs (*Herrera 3670*, UC).

branched veins from the costae of the segments or pinnae.

The most similar species to *Terpsichore* currently are classified in *Ctenopteris*, a diverse and probably polyphyletic genus typified by the Old World species *C. venulosa* (Blume) Kunze. A synonym of *Ctenopteris* is *Cryptosorus* [synonym: *Grammitis* sect. *Cryptosorus* (Fée) R. M. Tryon & A. F. Tryon], type *Cryptosorus blumei* Fée [≡ *Ctenopteris obliquata* (Blume) Copeland], also Old World. The type species of both *Ctenopteris* and *Cryptosorus*, as well as many allied Old World species (see Parris, 1990: 82), lack hydathodes, have subclathrate rhizome scales, and have sori sunken in crypts. In these three characteristics, *Ctenopteris* differs from all species here included in *Terpsichore*. Some other Old World species included in *Ctenopteris* do have hydathodes, nonclathrate rhizome scales, and nonsunken sori, characteristics that might suggest a closer affinity to *Terpsichore*. The affinities of the "nontypical," Old World *Ctenopteris* species need further study, but it seems clear that *Terpsichore* is not congeneric with any genus of Grammitidaceae based on an Old World type.

Certain species of *Terpsichore*, especially those in the *T. taxifolia* group (Group 2, below), also resemble *Pecluma* (Polypodiaceae) because of their pectinate laminae. *Pecluma*, however, has short phyllopodia, yellow, bilateral, monolete spores, and often comose rhizome scales; species of *Pecluma* also lack stout castaneous setae and black clavate fungi. It seems likely that the resemblance is the result of convergent evolution and is not an indication of any close affinity between the two genera.

In his revision of American *Ctenopteris*, Copeland (1956) treated the species of *Terpsichore* in seven of his nine species groups, exemplified by the following seven species: *Ctenopteris senilis*, *C. capillaris*, *C. elastica*, *C. pendula*, *C. suspensa*, *C. sericeolanata*, and *C. meridensis*. Copeland's groups bear little or no resemblance to the genera as Bishop and I have circumscribed them, and in fact Copeland's groups of species are mostly highly artificial assemblages based on size and dissection of the fronds, characters that are completely unreliable in defining natural groups of species in Grammitidaceae.

Species of *Terpischore* can be rather easily divided into the following five groups, which could conveniently be regarded as natural sections of the genus (Fig. 1).

Group 1. *Terpsichore asplenifolia* Group (12 spp.).—Fronds arching, blades determinate; rhizomes weakly dorsiventral to radial; rhizome scales orange to brown, setulose on margins and often surface; sporangia setose (except *T. atroviridis*); blades lacking black clavate fungal fruiting bodies; stipes distinct, the pinnae not reduced to base of frond; laminae with solitary setae; hydathodes lacking calcareous secretions (Fig. 1A).

Group 2. *Terpsichore taxifolia* Group (13 spp.).—Fronds arching to erect, blades determinate; rhizomes generally dorsiventral; rhizome scales castaneous, setose at tip and/or margins; sporangia glabrous; blades with black clavate fungal fruiting bodies (except *T. paulistana*); stipes distinct, the pinnae not reduced to base of frond; laminae with solitary setae; hydathodes often producing calcareous secretions (Fig. 1B).

Group 3. *Terpsicore lanigera* Group (16 spp.).—Fronds pendent, blades indeterminate; rhizomes generally radially symmetric; rhizome scales hairy on margins and often surface, or sometimes absent (*T. alfarii*); sporangia setose (except *T. delicatula*, *T. jamesonioides*, and *T. spathulata*); blades lacking black clavate fungal fruiting bodies; stipes usually less than 1 cm long, the pinnae reduced nearly to base of frond; laminae with tendency for paired or clustered setae (except *T. delicatula*, *T. jamesonioides*); hydathodes producing calcareous secretions in a few spp. (Fig. 1C).

Group 4. *Terpsichore subtilis* Group (2 spp.).—Fronds arching or directed downward, sometimes pendent, blades indeterminate; rhizomes weakly dorsiventral to radial; rhizome scales blackish, with a single apical seta or marginally setulose; sporangia glabrous; blades with black clavate fungal fruiting bodies; stipes less than 1 cm long, the pinnae reduced nearly to base of frond; laminae with solitary setae; hydathodes producing calcareous secretions (Fig. 1D).

Group 5. *Terpsichore achilleifolia* Group (3 spp.).—Fronds arching, blades determinate; rhizomes generally weakly dorsiventral; rhizome scales orangish to orange-brown, entire to glandular to sparingly setose on margin; sporangia glabrous; blades lacking black clavate fungal fruiting bodies; stipes distinct, the pinnae not reduced to base of frond; laminae with solitary setae; hydathodes lacking calcareous secretions (Fig. 1E).

The relationships among these groups are uncertain. The pendent, nearly estipitate fronds, radially symmetrical rhizomes, clustered setae, and usually setose sporangia of the *T. lanigera* group are probably derived features. In frond form, the *T. asplenifolia* group seems to be ancestral, possibly having given rise to *T. taxifolia* and allies, all but one of which bear black clavate fungi. Species in both the *asplenifolia* and *taxifolia* groups have more or less weakly dorsiventral rhizomes, thought by Bishop (1989) to be an ancestral condition in the family. In its orangish, entire or sparingly setose rhizome scales, the *T. achilleifolia* group is aberrant

TABLE 1. Spores of *Terpsichore*, *T. lanigera* group. Vouchers are all in UC. Less common conditions are in parentheses. Bo = Bolivia; Br = Brazil; C = Colombia; CR = Costa Rica; E = Ecuador; G = Guatemala; M = Mexico; Pa = Panama; Pe = Peru; V = Venezuela. e = ellipsoid; mo = monolete; o = oblate; t = tetrahedral; tr = trilete.

Species	Shape	Laesura	Number of cells	Voucher	Locality
T. alfarii	o	tr	1	*Fiedler 159*	CR
T. cultrata	e	mo	2	*Steyermark 48601*	G
	e	mo	2 (1)	*Silverstone-Sopkin 3614*	C
	t–o	tr	1 (2)	*Steyermark & Wurdack 1177*	V
	e	mo	1 (2)	*Steyermark 100715*	V
	t–o	tr	1 & 2	*Kral 71972B*	V
	t–o	tr	1 & 2	*Kummrow 2153*	Br
	t–o	tr	1 (2)	*Hutchison & Wright 5582*	Pe
	e & o	mo & tr	1 & 2	*Fay & Fay 2184*	B
T. delicatula	o	tr	1 (2)	*Smith 471*	M
T. hetermorpha	t–o	tr	1 & 2	*Cerón 1207*	E
	t–o	tr	1	*Øllgaard 34281*	E
T. jamesonioides	o	tr	1 & 2	*Bishop 2520*	Pe
T. lanigera	t–o	tr	1	*Herzog 2180*	Bo
	t–o	tr	1	*Wiggins 10768*	E
	t–o	tr	1	*Bishop 862*	CR
	e (o)	mo (tr)	1 & 2	*Mickel 3025*	CR
	e	mo	1 & 2	*Buchtien 5251*	Bo
	t–o	tr	1	*Sodiro s.n.*	E
T. laxa	e (o)	mo (tr)	1	*Bishop 2509*	Pe
T. longa	e	mo	1 (2)	*Gómez 21085*	CR
	e	mo	1 (2)	*Chacón 1518*	CR
	e	mo	1 (2)	*Palacios 5655*	E
	e	mo	1 & 2	*van der Werff 9488*	E
T. mollissima	e	mo	1	*Steyermark 49625*	G
	e	mo	1 & 2	*Skutch 5204*	CR
	e	mo	1 & 2	*Maguire 53790*	V
T. senilis	e	mo	2	*Breedlove 68357*	M
	e (t–o)	mo (tr)	1 & 2	*Bishop 861*	CR
	e	mo	1 & 2	*Gómez 22285*	Pa
	e	mo	2 (1)	*Smith et al. 1430*	V
	e	mo	1 or 2	*Steyermark & Liesner 118283*	V
T. spathulata	t–o	tr	1	*Purpus s.n.*	M
T. subflabelliformis	e	mo	1 & 2	*van der Werff 9148*	E
	e	mo	1 (2)	*Bishop 2515*	Pe
	e	mo	1 (2)	*Herzog 1985*	Bo
T. turrialbae	t–o	tr	1	*Smith 2073*	CR
	t–o	tr	1	*Bishop 859*	CR
T. xanthotrichia	e	mo	2	*Beitel 85083*	V

and may show a relationship to *Micropolypodium* or to some Old World species currently included in *Ctenopteris* (but not the type). The pinnate-pinnatifid fronds of three species belonging here are unusual in Grammitidaceae but are found in several species of *Lellingeria* (e.g., *L. suprasculpta*, *L. melanotrichia*). This character state (pinnate-pinnatifid lamina) has undoubtedly arisen several times among neotropical grammitids and also in the Old World genus *Ctenopteris* (e.g., *C. taxodioides* (Baker) Copeland, *C. bipinnatifida* (Baker) Copeland, and allies).

A peculiar feature in nearly all species of the *Terpsichore taxifolia* and *T. subtilis* groups is the presence of small (ca. 0.5–1.0 mm long), black, clavate fungi (presumably *Acrospermum maxonii* Farlow) on the abaxial laminae, particularly along the vascular tissue (rachis, costae, and veins) and in the sorus (Mickel, 1973). Not all fronds in a given collection will show this feature, but it is of such regular occurrence on at least some fronds of a gathering as to be diagnostic for the two groups. Most likely, the presence of this fungus on species in the two groups indicates a monophyletic origin

for this suite of about 15 species (Groups 2 and 4, below). The only other fern outside these groups that is a known host for this particular fungus is the grammitid *Melpomene anfractuosa* (Kunze ex Klotzsch) A. R. Smith & R. C. Moran.

Chromosome counts are known for a few species of *Terpsichore*, namely, *T. asplenifolia* ($n = 37$, $2n = 74$; Walker, 1966), *T. semihirsuta* ($2n$ = ca. 148; Walker, 1966), from Jamaica, and *T. lanigera* ($n = 37$; Evans, 1963, reported as *Ctenopteris cultrata*, a misidentification, UC 58-234-1), from Costa Rica. From these few reports, it would appear that the base number for the genus is $x = 37$, the same number found in several other grammitid genera, including *Ceradenia*, *Micropolypodium*, *Enterosora*, and *Melpomene*.

Tryon & Lugardon (1991: 363) provided an SEM photograph of a spore of *T. asplenifolia* that shows a spore that is nearly globose, with an obscure trilete aperture and finely papillate surface. Spores of other genera of Grammitidaceae shown in this work show similar features, but are sometimes more tetrahedral-globose and have more prominent apertures and papillae or surface globules. However, insufficient material has been studied to indicate the taxonomic significance, if any, of these variations in spore morphology in the family.

Wagner (1985) reported that spores of *Grammitis lanigera*, *G. senilis*, and several related grammitids had monolete laesurae. I confirm the presence of monolete spores in the first two species and in other species belonging to the *Terpsichore lanigera* group (Group 3, see below).

Ellipsoid, bilateral, monolete spores appear to be consistently present in *T. longa*, *T. mollissima*, *T. senilis*, and *T. xanthotrichia;* they are also sometimes present in *T. cultrata*, *T. lanigera*, and *T. laxa* (Table 1). The other species for which spore material has been available in Group 3 have globose-tetrahedral, trilete spores (Table 1), as do species examined in Groups 1, 2, and 4. The significance of ellipsoid, monolete spores in the genus is not known, but this character state is undoubtedly derived and does not indicate affinity with *Pecluma* or any other extant genera of Polypodiaceae, which nearly always have bilateral, monolete spores.

A peculiar feature of the spores of Grammitidaceae is that they often undergo precocious division within the spore wall before being released from the sporangium. Bicellular or multicellular spores are a feature of several other groups of ferns that produce chlorophyllous spores (Tryon & Lugardon, 1991). In *Terpsichore*, it appears that spores often undergo division before the spore wall is ruptured and before release from the sporangia (Table 1; Stokey & Atkinson, 1958).

New Species

Terpsichore pirrensis A. R. Smith, sp. nov. TYPE: Panama. Darién: Cerro Pirre, 2,500–4,500 ft., *Duke & Elias 13842* (holotype, UC; isotypes, MO, NY not seen, SCZ not seen). Figure 2A.

Ex affinitate *T. taxifoliae* (L.) A. R. Smith et *T. zeledonianae* (Lellinger) A. R. Smith, stipitis setis brevioribus hyalinis vel pallide rubellis 0.2–0.3 mm, rhachide glabra abaxialiter, et setis inter sporangia plerumque carentibus distinguenda; insuper differt a *T. taxifoliae* setis margine segmentorum carentibus.

Rhizome short-creeping to suberect; scales castaneous, concolorous, shining, 1.5–2.5 × 0.2–0.3 mm, entire, often with a single minute hyaline patent or oblique seta at tip; fronds mostly 15–30 cm; stipes dark brown, up to 8 cm × 0.5–1 mm, with hyaline to light reddish setulae 0.2–0.3 mm; laminae thin-chartaceous, pinnatisect, narrowly elliptic with proximal pinnae (up to ca. 12 pairs) gradually reduced to small lobes 1–3 mm long; rachises glabrous abaxially or with very sparse setae to 1.5 mm, also with black clavate fungi; segments mostly 30–55 pairs per frond, spreading to often ascending up to ca. 70° from rachis, linear-lanceolate, 1.5–2.5 cm × 2–3.5 mm, acutish at tip, lacking marginal and laminar setae; veins simple, blackish and easily visible abaxially, up to 15 pairs per segment; hydathodes lacking calcareous secretions; sori up to 15 pairs per segment, lacking setae from receptacle or setae sparse, less than 0.3 mm; sporangia glabrous.

This particular group, also including *T. taxifolia* (L.) A. R. Smith and *T. alsopteris* (C. V. Morton) A. R. Smith in Mesoamerica, is in need of revision, especially in South America where there are additional undescribed species. *Terpsichore pirrensis* is known only from Cerro Pirre.

Paratypes. PANAMA. **Darién:** same locality as type, *Duke & Elias 13754* (MO, NY not seen, SCZ not seen, UC); Serranía de Pirre, along steep ridge from Altos de Nique to Cerro Pirre, ca. 8 km N of Alturas de Nique, ca. 8 km W of Cana Gold Mine, 1,430–1,480 m, *Croat 37833* (MO); Cerro Pirre, valley between Pirre and next most southerly peak, *Folsom 4447* (MO).

Terpsichore spathulata A. R. Smith, sp. nov. TYPE: Mexico. México: Sierra de las Cruces, 11,000 ft., *Pringle 4145b* (holotype, UC; isotype, US). Figure 2B.

A *T. heteromorpha* (Hooker & Greville) A. R. Smith rhizomatis paleis parvioribus aurantiacis vel brunneolis, sporangiis sine setis, et laminis gracilioribus plerumque non furcatis aut si furcatis nunc divisionibus ca. 30° divergentibus differt.

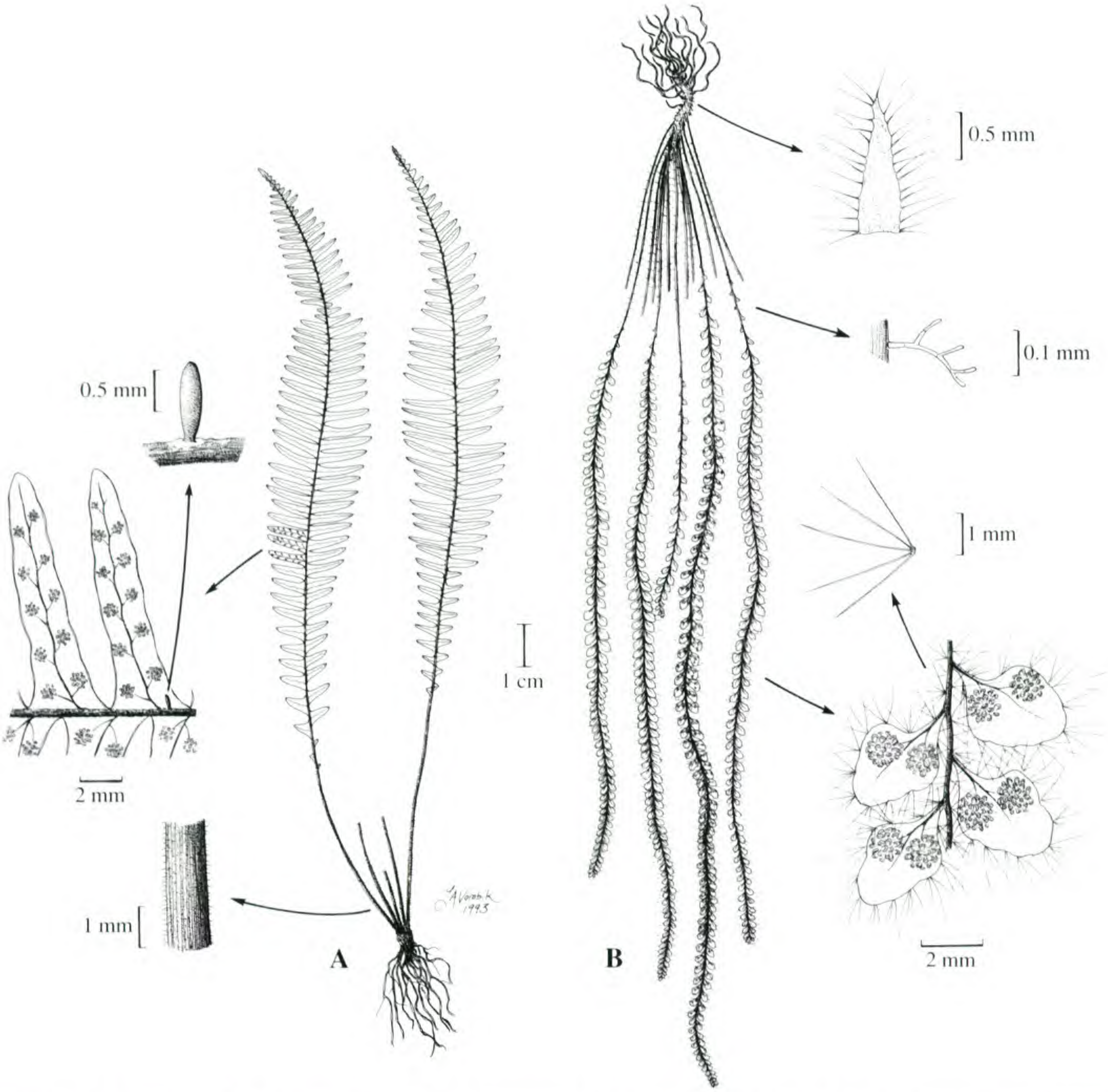

Figure 2. New species of *Terpsichore*. —A. *T. pirrensis* A. R. Smith, habit and details showing stipe base with uniformly short hairs, abaxial surface of segments, and fungal fruiting body from rachis (*Duke & Elias 13842*, UC). —B. *T. spathulata* A. R. Smith, habit and details showing rhizome scale, branched hair along rachis, stellate seta on rachis, and abaxial surface of segments, *Pringle 4145b* (UC).

Plants epipetric in moist, shaded rock crevices and on cliffs, under rock overhangs, and in shallow caves and grottoes; rhizome very short-creeping to suberect; scales orangish to brownish, concolorous, dull, 0.3–1 × 0.2–0.5 mm, somewhat obscured by dense, hyaline setae on margins and surfaces; fronds numerous, densely crowded, pendent, often more than 50 per plant, (12–)25–60(–90) cm, apices indeterminate; stipes brown, 20–150 × 0.2–0.4 mm, with numerous, mostly unbranched, tawny setae 1–2 mm; laminae 10–85 × 0.4–1.2(–1.6) cm, 1-pinnate, or occasionally rachises 1–2-bifurcate with forks ca. 30° apart, pinnae very gradually reduced and more widely separated proximally, contiguous or often overlapping distally, without black clavate fungi, thin-chartaceous; rachises brown to blackish, with numerous dark, often paired or fasciculate setae 1–2 mm; pinnae often more than 50 pairs per frond, alternate, 2–5(–7) × 2–4 mm, ascending, sessile or proximal ones stipitate to 2 mm, irregularly oval, obovate, rhombic, or slightly lobed, larger ones often inequilateral (excised basiscopically), base cuneate, apex rounded or truncate, margin setose, setae pale reddish, not paired, paired, and/or sessile-stellate; veins obscure except for the darkened costa (basal half), 1–3 pairs per pinna; laminar surface between the veins glabrous or with pale setae on both surfaces, often also with 1–3-branched hairs 0.1–0.2

mm; hydathodes without lime dots; sori usually 2–6 per pinna, lacking setae from receptacle; sporangia glabrous.

Specimens of *Terpsichore spathulata* from Mexico and Central America have previously been determined as *Grammitis heteromorpha* (Hooker & Greville) C. V. Morton. The latter species is restricted to the Andes from Colombia to Bolivia and differs by the larger (1–1.5 mm), black rhizome scales, thicker lamina and rachises, and presence of sporangial setae. In addition, Andean specimens have the lamina markedly and regularly bifurcate, with the blade forks diverging at 60–90°. Smith (1981) and Stolze (1981) have previously discussed some of the variation in *Grammitis heteromorpha* sensu lato.

Paratypes. MEXICO. **Chiapas:** Munic. Union Júarez, SE side of summit of Volcán Tacaná, 12,500 ft., *Breedlove 24297, 24303, 24304* (DS); Volcán Tacaná, 2,800 m, *Matuda 2890* m (K, MEXU, NY, US). **Distrito Federal:** Desierto de los Leones, ca. 9,600 ft., *Hernandez X. s.n.* (US), *Lyonnet 232* (US). **Jalisco:** Nevado de Colima, above Jazmín, above El Isote, 2,600 m, *McVaugh 10043* (US), 3,200 m, *McVaugh 10073* (US), ca. 4,000 m, *McVaugh 13820* (US). **México:** Sierra de las Cruces, *Pringle 4145* (US); Ixtaccíhuatl, above San Rafael, ca. 4,040 m, *Beaman 2817* (UC, US); Ixtaccíhuatl, La Joya, 3,990 m, *Beaman 3514* (US); Ixtaccíhuatl, 12,000–13,000 ft., *Purpus s.n.* (UC), *172* (US), *1596* (UC, US), 3,500 m, *Matuda 27574* (US), 4,100 m, *Rzedowski 25410* (US); La Ciénega, cerca del Llano Grande, Ixtaccíhuatl, *Rzedowski 29309* (US); arriba de El Salto, Valle de Ayoloco, Ixtaccíhuatl, *Rzedowski 23465* (US); Volcán Ixtaccíhuatl, *Moore et al. 4526* (UC, US); SE de Ixtaccíhuatl, 3,600 m, *Matuda 26113, 26114* (US); Popocatapetl, 3,400 m, *Sanchez M. 423* (US); between Km 76 and 77 on Amecameca–Popocatepetl road, ca. 3,250 m, *Beaman 2060* (UC); Cerro Cabezas, 3,500 m, *Lyonnet 1479, Sanchez S. 364* (US); Xitle Chico, *Rzedowski 938* (US). **Veracruz:** Orizaba, 11,000 ft., *Plantae Mexicanae Liebmann 2508* (US); Munic. Calcahualco, 5 km SW of Jacal, 19°05′N, 97°15′W, 3,450 m, *Nee & Diggs 24843* (UC). GUATEMALA. **Sacatepéquez:** Volcán de Agua, 3,400–3,752 m, *Pittier 24* (US). **San Marcos:** upper slopes of Volcán Tacaná, 4,100–4,400 m, *Steyermark 36134* (US).

New Combinations

Terpsichore achilleifolia (Kaulfuss) A. R. Smith, comb. nov. Basionym: *Polypodium achilleifolium* Kaulfuss, Enum. Fil. 116. 1824. *Ctenopteris achilleifolium* (Kaulfuss) J. Smith. *Grammitis achilleifolia* (Kaulfuss) R. M. Tryon & A. F. Tryon. *Distribution.* Southern Brazil. Group 5.

A species from Madagascar and the Mascarenes, *Ctenopteris torulosa* (Baker) Tardieu, is very similar to *Terpsichore achilleifolia* in blade dissection but apparently lacks hydathodes or has only faint hydathodes (Barbara Parris, in litt.).

Terpsichore alfarii (Donnell Smith) A. R. Smith, comb. nov. Basionym: *Polypodium alfarii* Donnell Smith, Bot. Gaz. 33: 262. 1902. *Ctenopteris alfarii* (Donnell Smith) Copeland. *Grammitis alfarii* (Donnell Smith) C. V. Morton. *Polypodium oligosorum* Mettenius ex Kuhn, non Klotzsch. *Distribution.* Costa Rica, Venezuela, Colombia, Ecuador. Group 3.

Terpsichore alsophilicola (H. Christ) A. R. Smith, comb. nov. Basionym: *Polypodium alsophilicola* H. Christ, Bull. Soc. Bot. Genève, II, 1: 219. 1909, as *P. alsophilicolum. Ctenopteris alsophilicola* (H. Christ) Copeland. *Grammitis alsophilicola* (H. Christ) F. Seymour. *Distribution.* Costa Rica, Panama, Colombia?, Ecuador. Group 1.

Terpsichore alsopteris (C. V. Morton) A. R. Smith, comb. nov. Basionym: *Grammitis alsopteris* C. V. Morton, Contr. U.S. Natl. Herb. 38: 112, t. 4. 1967. *Distribution.* Costa Rica, Panama, Colombia, Ecuador, Peru. Group 2.

Terpsichore amphidasyon (Kunze ex Mettenius) A. R. Smith, comb. nov. Basionym: *Polypodium amphidasyon* Kunze ex Mettenius, Abh. Senckenberg. Naturf. Ges. 2: 49. 1857. *Grammitis amphidasyon* (Kunze ex Mettenius) Duek & Lellinger. *Xiphopteris amphidasyon* (Kunze ex Mettenius) Alston. *Distribution.* Venezuela. Group 2.

Terpsichore angustipes (Copeland) A. R. Smith, comb. nov. Basionym: *Ctenopteris angustipes* Copeland, Philipp. J. Sci. 84: 404. 1956. *Grammitis angustipes* (Copeland) Lellinger. *Distribution.* Colombia. Group ?

Terpsichore asplenifolia (L.) A. R. Smith, comb. nov. Basionym: *Polypodium asplenifolium* L., Sp. Pl. 2: 1084. 1753. *Ctenopteris asplenifolia* (L.) Copeland. *Grammitis asplenifolia* (L.) Proctor. *Distribution.* Southern Mexico to Panama, Colombia and Venezuela to Bolivia, Antilles. Group 1.

Terpsichore athyrioides (Hooker) A. R. Smith, comb. nov. Basionym: *Polypodium athyrioides* Hooker, Sp. Fil. 4: 224, t. 277B. 1862. *Ctenopteris athyrioides* (Hooker) Copeland. *Grammitis athyrioides* (Hooker) C. V. Morton. *Distribution.* Peru, Bolivia. Group 2.

Polypodium yungense Rosenstock, Repert. Spec. Nov. Regni Veg. 5: 236. 1908. *Xiphopteris yungensis* (Rosenstock) Crabbe.

Terpsichore atroviridis (Copeland) A. R. Smith, comb. nov. Basionym: *Ctenopteris atroviridis* Copeland, Philipp. J. Sci. 84: 461. 1956. *Grammitis atroviridis* (Copeland) F. Seymour. *Distribution.* Nicaragua, Costa Rica, Panama. Group 1.

Terpsichore attenuatissima (Copeland) A. R. Smith, comb. nov. Basionym: *Ctenopteris attenuatissima* Copeland, Philipp. J. Sci. 84: 456, t. 11. 1956. *Grammitis attenuatissima* (Copeland) C. V. Morton. *Distribution.* Ecuador. Group 2.

Terpisichore chrysleri (Copeland) A. R. Smith, comb. nov. Basionym: *Ctenopteris chrysleri* Copeland, Philipp. J. Sci. 84: 448. 1956. *Grammitis chrysleri* (Copeland) Proctor. *Distribution.* Costa Rica, Panama, Colombia and Venezuela to Bolivia, Brazil, Jamaica, Hispaniola. Group 1.

Terpsichore concinna (A. R. Smith) A. R. Smith, comb. nov. Basionym: *Grammitis concinna* A. R. Smith, Ann. Missouri Bot. Gard. 76: 338. 1989. *Polypodium concinnum* Mettenius ex Kuhn, Linnaea 36: 132. 1869, not Willdenow, Sp. Pl., ed. 4. 5: 201. 1810 (= *Thelypteris concinna* (Willd.) Ching). *Distribution.* Venezuela. Group 3.

Terpsichore cretata (Maxon) A. R. Smith, comb. nov. Basionym: *Polypodium cretatum* Maxon, Amer. Fern J. 5: 51. 1915. *Ctenopteris cretata* (Maxon) Copeland. *Grammitis cretata* (Maxon) Proctor. *Distribution.* Cuba, Hispaniola, Jamaica. Group 4.

Terpsichore cultrata (Bory ex Willdenow) A. R. Smith, comb. nov. Basionym: *Polypodium cultratum* Bory ex Willdenow, Sp. Pl., ed. 4. 5: 187. 1810. *Ctenopteris cultrata* (Bory ex Willdenow) Copeland. *Grammitis cultrata* (Bory ex Willdenow) Proctor. *Xiphopteris cultrata* (Bory ex Willdenow) Schelpe. *Distribution.* Southern Mexico to Panama, Colombia and Venezuela to Bolivia, Brazil, Antilles; Africa, Madagascar, Mauritius, Réunion, and the Seychelles Islands. Group 3.

Polypodium elasticum Bory ex Willdenow, Sp. Pl., ed. 4. 5: 183. 1810. *Ctenopteris elastica* (Bory ex Willdenow) Copeland. *Xiphopteris elastica* (Bory ex Willdenow) Alston.

Polypodium reclinatum Brackenridge, Expl. Exp. 16: 11. 1854. *Ctenopteris reclinata* (Brackenridge) Copeland.

Polypodium ciliare Fée, Crypt. Vasc. Brésil 1: 94, t. 27, f. 2. 1869. *Ctenopteris ciliaris* (Fée) Copeland.

Polypodium ovalescens Fée, Crypt. Vasc. Brésil 1: 94, t. 27, f. 3. 1869.

Terpsichore david-smithii (Stolze) A. R. Smith, comb. nov. Basionym: *Grammitis david-smithii* Stolze, Fieldiana, Bot., n.s. 32: 109. 1993. *Distribution.* Peru, Bolivia. Group 2.

Terpsichore delicatula (M. Martens & Galeotti) A. R. Smith, comb. nov. Basionym: *Polypodium delicatulum* M. Martens & Galeotti, Nouv. Mém. Acad. Roy. Sci. Bruxelles 15(5): 35, pl. 7, f. 1. 1842. *Ctenopteris delicatula* (M. Martens & Galeotti) J. Smith. *Grammitis delicatula* (M. Martens & Galeotti) F. Seymour. *Distribution.* Southern Mexico, Guatemala. Group 3.

Terpsichore dependens (Baker) A. R. Smith, comb. nov. Basionym: *Polypodium dependens* Baker, Syn. Fil. 335. 1867. *Grammitis dependens* (Baker) C. V. Morton. *Distribution.* Colombia, Ecuador, Peru, Bolivia. Group 3.

Terpsichore dolorensis (Hieronymus) A. R. Smith, comb. nov. Basionym: *Polypodium dolorense* Hieronymus, Bot. Jahrb. Syst. 34: 512. 1905. *Grammitis dolorensis* (Hieronymus) Lellinger. *Distribution.* Colombia. Group 1.

Terpsichore eggersii (Baker ex Hooker) A. R. Smith, comb. nov. Basionym: *Polypodium eggersii* Baker ex Hooker, Icon. Pl. t. 1671. 1886. *Grammitis eggersii* (Baker ex Hooker) Proctor. *Distribution.* Lesser Antilles. Group 1.

Terpsichore exornans (Maxon) A. R. Smith, comb. nov. Basionym: *Polypodium exornans* Maxon, Amer. Fern J. 18: 47. 1928. *Ctenopteris exornans* (Maxon) Copeland. *Grammitis exornans* (Maxon) Proctor. *Distribution.* Jamaica. Group 1.

Terpsichore gradata (Baker) A. R. Smith, comb. nov. Basionym: *Polypodium gradatum* Baker, Fl. Bras. 1(2): 513. 1870. *Ctenopteris gradata* (Baker) Copeland. *Grammitis gradata* (Baker) R. M. Tryon & A. F. Tryon. *Distribution.* Southern Brazil. Group 5.

Polypodium schwackei H. Christ in Schwacke, Pl. Nov. Mineiras 2: 20. 1900. *Ctenopteris schwackei* (H. Christ) Copeland.

Terpsichore hanekeana (Proctor) A. R. Smith, comb. nov. Basionym: *Grammitis hanekeana* Proctor, Mem. New York Bot. Gard. 53: 341. 1989. *Distribution.* Puerto Rico. Group 1.

Terpsichore heteromorpha (Hooker & Greville) A. R. Smith, comb. nov. Basionym: *Polypodium heteromorphum* Hooker & Greville, Icon. Fil. 1: pl. 108. 1829. *Ctenopteris heteromorpha* (Hooker & Greville) Copeland. *Grammitis*

heteromorpha (Hooker & Greville) C. V. Morton. *Xiphopteris heteromorpha* (Hooker & Greville) Crabbe. *Distribution.* Colombia, Ecuador, Peru. Group 3.

Terpsichore immixta (Stolze) A. R. Smith, comb. nov. Basionym: *Grammitis immixta* Stolze, Fieldiana, Bot., n.s. 32: 115. 1993. *Distribution.* Peru. Group 3.

Terpsichore jamesonioides (Fée) A. R. Smith, comb. nov. Basionym: *Polypodium jamesonioides* Fée, Mém. Soc. Sci. Hist. Nat. Strasbourg 5 [Mém. Foug. 7]: 59, t. 21, f. 4. 1857. *Ctenopteris jamesonioides* (Fée) Copeland. *Grammitis jamesonioides* (Fée) C. V. Morton. *Distribution.* Costa Rica, Panama, Venezuela and Colombia to Peru. Group 3.

Ctenopteris nudipes Copeland, Philipp. J. Sci. 84: 405, t. 4. 1956.

Terpsichore jenmanii (Underwood ex Maxon) A. R. Smith, comb. nov. Basionym: *Polypodium jenmanii* Underwood ex Maxon, Contr. U.S. Natl. Herb. 16: 62. 1912. *Ctenopteris jenmanii* (Underwood ex Maxon) Copeland. *Grammitis jenmanii* (Underwood ex Maxon) Proctor. *Distribution.* Jamaica and Hispaniola. Group 1.

Terpsichore kegeliana (Kunze) A. R. Smith, comb. nov. Basionym: *Polypodium kegelianum* Kunze, Linnaea 21: 210. 1848. *Ctenopteris kegeliana* (Kunze) K. U. Kramer. *Grammitis kegeliana* (Kunze) Lellinger. *Distribution.* Surinam, French Guiana. Group ?

Terpsichore lanigera (Desvaux) A. R. Smith, comb. nov. Basionym: *Polypodium lanigerum* Desvaux, Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk. 5: 316. 1811. *Ctenopteris lanigera* (Desvaux) Copeland. *Grammitis lanigera* (Desvaux) C. V. Morton. *Xiphopteris lanigera* (Desvaux) Crabbe. *Distribution.* Costa Rica, Panama, Colombia to Bolivia, Hispaniola, Lesser Antilles. Group 3.

Terpsichore laxa (C. Presl) A. R. Smith, comb. nov. Basionym: *Polypodium laxum* C. Presl, Reliq. Haenk. 1: 23, t. 4, f. 1. 1825. *Grammitis laxa* (C. Presl) C. V. Morton. *Distribution.* Ecuador, Peru, Bolivia. Group 3.

Ctenopteris contacta Copeland, Philipp. J. Sci. 84: 447. 1956.

Terpsichore lehmanniana (Hieronymus) A. R. Smith, comb. nov. Basionym: *Polypodium lehmannianum* Hieronymus, Bot. Jahrb. Syst. 34: 513. 1904. *Ctenopteris lehmanniana* (Hieronymus) Copeland. *Distribution.* Guatemala to Panama, Colombia, Ecuador. Group 1.

Terpsichore leucosticta (J. Smith) A. R. Smith, comb. nov. Basionym: *Ctenopteris leucosticta* J. Smith, Hist. Fil. 185. 1875, a nom. nov. for *Polypodium leucosticton* Fée, not Kunze ex Klotzsch (1847), Gen. Fil. 240. 1852. *Polypodium longiusculum* C. Christensen, nom. nov. for *P. leucosticton* Fée. *Ctenopteris longiuscula* (C. Christensen) Copeland. *Grammitis leucosticta* (J. Smith) C. V. Morton. *Distribution.* Venezuela, Ecuador, Peru. Group 2.

Terpsichore liogieri (Proctor) A. R. Smith, comb. nov. Basionym: *Grammitis liogieri* Proctor, Mem. New York Bot. Gard. 53: 341. 1989. *Distribution.* Puerto Rico. Group 1.

Terpsichore longa (C. Christensen) A. R. Smith, comb. nov. Basionym: *Polypodium longum* C. Christensen, Index. Fil. 541. 1906, a nom. nov. for *P. alternifolium* Hooker, Sp. Fil. 4: 222, t. 277A, 1862, not Willdenow, Sp. Pl., ed. 4. 5: 168. 1810 (= *Microsorum alternifolium* (Willdenow) Copel). *Ctenopteris longa* (C. Christensen) Copeland. *Xiphopteris longa* (C. Christensen) Alston. *Distribution.* Costa Rica, Ecuador. Group 3.

Terpsichore longisetosa (Hooker) A. R. Smith, comb. nov. Basionym: *Polypodium longisetosum* Hooker, Sp. Fil. 4: 225. 1864. *Distribution.* Costa Rica, Panama, Venezuela, Ecuador to Bolivia. Group 5.

Polypodium myriophyllum Mettenius ex Hooker & Baker, Syn. Fil. 338. 1868. *Ctenopteris myriophylla* (Mettenius ex Hooker & Baker) Copeland. *Grammitis myriophylla* (Mettenius ex Hooker & Baker) C. V. Morton. *Xiphopteris myriophylla* (Mettenius ex Hooker & Baker) Crabbe.

Polypodium piligerum Hooker (Hooker's Icon. Pl. 4: t. 321. 1841), type from Ecuador, appears to be this species and an earlier name, but the rhizome was described as with scales "nigro-fuscentibus, nitidis." Specimens of *T. longisetosa* seen from Mesoamerica, as well as from Venezuela and Ecuador, have orange-brown, rather dull scales. Morton (1967) did not account for *Polypodium piligerum* in his treatment of Grammitidaceae for Ecuador.

Terpsichore mollissima (Fée) A. R. Smith, comb. nov. Basionym: *Polypodium mollissimum* Fée, Hist. Foug. Antill. [Mém. Foug. 11]: 47, t. 12, f. 2. 1866. *Ctenopteris mollissima* (Fée) Copeland. *Grammitis mollissima* (Fée) Proctor.

Distribution. Southern Mexico to Panama, Venezuela, Ecuador, Antilles. Group 3.

Terpsichore paulistana (Brade & Rosenstock) A. R. Smith, comb. nov. Basionym: *Polypodium paulistanum* Brade & Rosenstock, Arch. Inst. Biol. Veg. Rio Janeiro 2: 3, t. 1(4), 4. 1935. *Distribution.* Southern Brazil. Group 2.

Terpsichore pichinchae (Sodiro) A. R. Smith, comb. nov. Basionym: *Polypodium pichinchae* Sodiro, Crypt. Vasc. Quit. 329. 1893. *Ctenopteris pichinchae* (Sodiro) Copeland. *Grammitis pichinchae* (Sodiro) C. V. Morton. *Distribution.* Ecuador. Group 2.

Terpsichore pichinchense (Hieronymus) A. R. Smith, comb. nov. Basionym: *Polypodium pichinchense* Hieronymus, Bot. Jahrb. Syst. 34: 506. 1904. *Polypodium ecuadorense* C. Christensen, nom. superfl. *Grammitis pichinchense* (Hieronymus) C. V. Morton. *Distribution.* Ecuador, Peru. Group 2.

Terpsichore semihirsuta (Klotzsch) A. R. Smith, comb. nov. Basionym: *Polypodium semihirsutum* Klotzsch, Linnaea 20: 379. 1847. *Ctenopteris semihirsuta* (Klotzsch) Copeland. *Grammitis semihirsuta* (Klotzsch) Proctor. *Distribution.* Southern Mexico to Panama, Jamaica, Hispaniola, Venezuela and Colombia to Bolivia, Brazil. Group 2.

Polypodium gratum Fée, Crypt. Vasc. Brésil 1: 242, t. 76, f. 2. 1869.

Terpsichore senilis (Fée) A. R. Smith, comb. nov. Basionym: *Polypodium senile* Fée, Mém. Soc. Sci. Hist. Nat. Strasbourg 5 [Mém. Foug. 7]: 60, t. 25, f. 1. 1857. *Ctenopteris senilis* (Fée) Copeland. *Grammitis senilis* (Fée) C. V. Morton. *Distribution.* Southern Mexico to Panama, Colombia, Venezuela, Ecuador, Peru, and Bolivia. Group 3.

Polypodium subflabelliforme Rosenstock, Repert. Spec. Nov. Regni Veg. 7: 306. 1909. *Ctenopteris subflabelliformis* (Rosenstock) Copeland. *Grammitis subflabelliformis* (Rosenstock) C. V. Morton.

Terpsichore staheliana (Posthumus) A. R. Smith, comb. nov. Basionym: *Polypodium staheli-anum* Posthumus, Recueil Trav. Bot. Néerl. 23: 401. 1928. *Ctenopteris staheliana* (Posthumus) K. U. Kramer. *Grammitis staheliana* (Posthumus) Lellinger. *Distribution.* Nicaragua, Costa Rica, Panama, Surinam, Venezuela, Colombia? Group 1.

Terpsichore subtilis (Kunze ex Klotzsch) A. R. Smith, comb. nov. Basionym: *Polypodium subtile* Kunze ex Klotzsch, Linnaea 20: 375. 1847. *Ctenopteris subtilis* (Kunze ex Klotzsch) J. Smith. *Grammitis subtilis* (Kunze ex Klotzsch) C. V. Morton. *Distribution.* Southern Mexico to Panama, Venezuela, Colombia, Ecuador. Group 4.

Terpsichore taxifolia (L.) A. R. Smith, comb. nov. Basionym: *Polypodium taxifolium* L., Sp. Pl. 2: 1086. 1753. *Ctenopteris taxifolia* (L.) Copeland. *Grammitis taxifolia* (L.) Proctor. *Distribution.* Costa Rica, Panama, Antilles, Venezuela, Ecuador, Surinam, Brazil. Group 2.

Polypodium l'herminieri Fée var. *costaricense* Rosenstock, Repert. Spec. Nov. Regni Veg. 22: 17. 1925.

Terpsichore turrialbae (H. Christ) A. R. Smith, comb. nov. Basionym: *Polypodium turrialbae* H. Christ, Bull. Soc. Roy. Bot. Belgique 35: Mém. 226. 1896. *Ctenopteris turrialbae* (H. Christ) Copeland. *Grammitis turrialbae* (H. Christ) F. Seymour. *Distribution.* Costa Rica, Panama. Group 3.

Terpsichore variabilis (Mettenius ex Kuhn) A. R. Smith, comb. nov. Basionym: *Polypodium variabile* Mettenius ex Kuhn, Linnaea 36: 133. 1869. *Grammitis variabilis* (Mettenius ex Kuhn) C. V. Morton. *Distribution.* Colombia, Ecuador, Peru. Group 3.

Terpsichore xanthotrichia (Klotzsch) A. R. Smith, comb. nov. Basionym: *Polypodium xanthotrichium* Klotzsch, Linnaea 20: 376. 1847. *Grammitis xanthotrichia* (Klotzsch) Duek & Lellinger. *Distribution.* Venezuela. Group 3.

Terpsichore zeledoniana (Lellinger) A. R. Smith, comb. nov. Basionym: *Grammitis zeledoniana* Lellinger, Proc. Biol. Soc. Wash. 98: 383. 1985, nom. nov. for *Polypodium taxifolium* L. var. *fragillimum* H. Christ, Bull. Herb. Boissier, sér. 2. 4: 1103. 1904. *Distribution.* Costa Rica, Panama. Group 2.

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Notes on *Elaeagia myriantha*, Comb. Nov. (Rubiaceae)

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ABSTRACT. Observations of recent fruiting collections of *Simira myriantha* (Standley) Steyermark, a tree found in wet mid-elevation forests from southern Costa Rica to Peru, support the following transfer of this species to *Elaeagia*.

Sickingia myriantha Standley was originally described from flowering material from northern Colombia, but Standley himself later erected the monotypic genus *Holtonia* to accommodate this species, as *Holtonia myriantha* (Standley) Standley. Even though classification within the Rubiaceae has been strongly dependent on knowledge of mature fruits, which were lacking for this taxon, Standley (1938) placed *Holtonia* in the Rondeletieae along with *Sickingia* Willdenow.

Steyermark (1972) determined that *Sickingia* is a synonym of *Simira* Aublet and published new combinations in *Simira* for all *Sickingia* species, including *Sickingia myriantha*. In that work he considered the placement of this species in *Elaeagia*, but rejected this conclusion based on its corolla aestivation. He stated only that the aestivation differed, but did not describe its condition. Steyermark (1974) later presented a detailed description of this species, although the mature fruits were still unknown and his description of them was sketchy.

Recent botanical exploration, particularly in Colombia, has made more material of this species available, including mature fruiting specimens. The fruits are small (2–3 mm long), loculicidal woody capsules that dehisce only partially, apparently allowing a "salt-shaker" dispersal of the numerous small angled seeds. The fruits and seeds are decidedly not those of *Simira*, which has larger (> 1 cm diam.), completely dehiscent capsules with broad, flat, samaralike seeds. Rather, they are characteristic of *Elaeagia* Weddell and *Warszewiczia* Klotzsch, sympatric genera of neotropical trees. These genera are distinguished in part by their corolla aestivation, convolute in *Elaeagia* and imbricate in *Warszewiczia*. Aestivation of the species in question is nearly valvate to slightly convolute, more like that of *Elaeagia*, rather than imbricate as originally implied by Standley when he described this species in *Sickingia*. "*Holtonia*" also shares with *Elaeagia* species rounded to truncate stipules (vs. acute in *Warszewiczia*), resinous terminal buds (vs. nonresinous in *Warszewiczia*), glomerulate cymes arranged in pyramidal paniculate inflorescences, and white, short tubular-funnelform corollas with exserted stamens that are barbate near their insertion (similar in *Warszewiczia*). Thus, because of its fruits "*Holtonia myriantha*" is not a *Simira* but rather an *Elaeagia*, and a slight variation in corolla aestivation does not warrant maintaining *Holtonia* as a separate genus.

We present below an expanded morphological description and geographic range for this species, and a selected list of specimens, in addition to types, on which these are based. Representative specimens from Venezuela were cited by Steyermark (1974). This species is distinguished within *Elaeagia* by its persistent, relatively short rounded to truncate stipules. It appears to be most closely related to *E. cubensis* Britton, which shares membranaceous, relatively short stipules that persist on several distal nodes. However, the stipules of *E. cubensis* are ultimately completely deciduous and shorter, and the corolla is campanulate.

Elaeagia Weddell, Hist. Nat. Quinquinas 24. 1849. TYPE: *Elaeagia utilis* Weddell.

Holtonia Standley, Trop. Woods 30: 37. 1932, syn. nov. TYPE: *Holtonia myriantha* (Standley) Standley, based on *Sickingia myriantha* Standley.

Elaeagia myriantha (Standley) C. M. Taylor & Hammel, comb. nov. Basionym: *Sickingia myriantha* Standley, Publ. Field Columbian Mus., Bot. Ser. 7(1): 27. 1930. *Holtonia myriantha* (Standley) Standley, Trop. Woods 30: 37. 1932. *Simira myriantha* (Standley) Steyermark, Mem. New York Bot. Gard. 23: 306. 1972. TYPE: Colombia. Magdalena: Las Nubes road, region of Santa Marta, 1,200 m, 3 Dec. 1898, *H. H. Smith 1810* (holotype, F; isotypes, MO, NY not seen, US not seen).

Deppea panamensis Dwyer, Ann. Missouri Bot. Gard. 67: 145. 1980, syn. nov. TYPE: Panama. Panamá: 5–10 km NE of Altos de Pacora, *Mori & Kallunki 4965* (holotype, MO).

Trees to 20 m tall, buds resinous; bark gray, rough; stems pilosulous to glabrescent. Leaves op-

posite, elliptic, 8–22 cm long, 2.5–10 cm wide, acute at base, acute to shortly acuminate at apex, chartaceous to stiffly so, glabrous above, below glabrous to puberulent or pilosulous, frequently barbate with tufted domatia in vein axils; secondary veins 8–12 pairs; petioles 7–25 mm long; stipules persistent, inter- and intrapetiolar, resinous when young, glabrous to pilosulous, 2–5 mm long, subtruncate to lobed for ca. ⅓ of their length, not splitting to base, lobes rounded to obtuse. Inflorescences terminal, paniculate, pyramidal, peduncles 0 (and inflorescences tripartite) to 1–7 cm long, panicles 6–11 cm long, 7–14 cm wide, bracts triangular, those subtending branches 1–3 mm long and those subtending flowers ca. 0.5 mm long, branches and bracts glabrous to pilosulous; flowers sessile or with pedicels to 1 mm long in glomerules of 2–8, homostylous, proterogynous; ovary turbinate, 1–1.5 mm long; calyx limb ca. 0.5 mm long, dentate for ca. ½ of its length, lobes 5, acute to obtuse; corolla shortly tubular-funnelform, white to creamy yellow, glabrous externally, internally densely white-villous, tube 3.5–4 mm long, lobes 5, ca. 0.5 mm long, acute to obtuse, aestivation valvate to slightly convolute; stamens 5, inserted near apex of corolla tube, the anthers ca. 1.5 mm long, exserted by ca. 1 mm; stigmas 2, 1–1.5 mm long, linear, recurved, shortly exserted. Fruit capsular, ellipsoid to turbinate, woody, 2–3 mm long, 1.5–2.5 mm wide, loculicidal, basipetally dehiscent, opening for ca. ½ of its length; seeds angled, pale brown, 0.2–0.5 mm diam.

Distribution and habitat. Wet forests at (400–)1,600–2,200(–2,350) m, southern Costa Rica to Andean Venezuela and northern Peru, most frequently collected in northern and central Colombia.

Phenology. Collected in flower January, March, April, and September to November, in fruit March, April, June, July, and October to December.

Representative specimens studied. COLOMBIA. **Antioquia:** autopista Medillín–Bogotá, sector río Samaná–río Claro, San Luis, *Hernández et al. 522* (COL). **Cauca:** Popayán, Timbío en Hatoviejo, *Pérez & Cuatrecasas 6107* (COL). **Magdalena:** Campano, Sierra Nevada de Santa Marta, Minca, 11°08′N, 74°01′W, *Gentry & Cuadros 64762* (MO). **Quindió:** municipio Salento, vereda río Arriba, Hacienda El Cairo, *Arbelaez et al. 2563* (COL, HUQ). **Valle:** hoya del río Cali, río Pichindé, en Los Cárpatos, *Cuatrecasas 21625* (CUVC, VALLE). COSTA RICA. **Puntarenas:** Reserva Biológica Carara, sitio Bijagual, *Zúñiga 407* (CR). **San José:** Zona Protectora Cerro Turrubares, *Hammel et al. 18967* (CR); El General, *Skutch 2387* (MO). ECUADOR. **Napo:** carretera Hollín–Loreto, Km 40–50, *Hurtado 777* (MO). **Pastaza:** Hacienda San Antonio de Baron von Humboldt, 2 km al norte de Mera, 1°27′S, 78°06′W, *Neill et al. 6069* (MO). PERU. **Cusco:** Paucartambo, Atalaya a Chontachaca, alrededor de la carretera en la ruta hacia Shintuya, *Núñez 8074* (MO).

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A New Species of *Faramea* (Rubiaceae) from Amazonian Peru

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ABSTRACT. A new species of Rubiaceae from Amazonian Peru, *Faramea vasquezii* C. M. Taylor, described and illustrated here, appears to be related to *F. capillipes* and *F. quadricostata*.

Faramea Aublet is a neotropical genus of perhaps 100 species distributed from southern Mexico and the Antilles to Paraguay and Bolivia. It is considered closely allied to *Coussarea* Aublet, and these two genera comprise the tribe Coussareae. *Faramea* is distinguished within the Rubiaceae by its one-locular ovary with separate basal ovules and fruits usually with only one developed seed. Additionally, *Faramea* can usually be recognized by its stipules that terminate interpetiolarly in a triangular, usually aristate segment, branches with the leaves usually held in a distichous attitude (and the internodes twisted ca. 90° to accommodate this arrangement), white or frequently bright blue corollas usually with a well-developed tube, subglobose to frequently strongly oblate leathery fruits, and seeds with a chartaceous testa. The aristae of the stipules frequently are elongated and crossed at the stem apex. The leaves of a few species have pronounced brochidodromus venation similar to that of many Melastomataceae, with well-developed submarginal veins and secondary veins spreading at right angles from the midrib; however, the venation of *Faramea vasquezii* C. M. Taylor is more typical of *Faramea*.

During a review of the Rubiaceae known from Peru (Taylor & Pool, 1993), the following new species was discovered.

Faramea vasquezii C. M. Taylor, sp. nov. TYPE: Peru. Loreto: Maynas, Alpahuayo, Estación IIAP, 20 Oct. 1984, *R. Vásquez & G. Criollo 5785* (holotype, MO; isotypes, AMAZ, USM). Figure 1.

Faramea capillipedi Mueller Argoviensis affinis, sed ab ea internodiis costatis complanatis, foliis minoribus nerviis secundariis paucioribus munitis, lobulis calycinis longioribus ac lobulis corollinis brevioribus differt.

Glabrous shrubs or small trees to 4 m tall (flowering at 0.3 m tall); stems strongly flattened and costate, the distalmost internodes 3–6 mm wide below the leaves. Leaves opposite; blades elliptic to rarely somewhat lanceolate, 13–23 cm long, 3–9.5 cm wide, at apex acuminate with tip 1.2–2 cm long, at base cuneate to usually acute or sometimes attenuate, subcoriaceous, glabrous; secondary veins 10–14 pairs, looping to interconnnect, with 1(–2) intersecondary veins usually well developed, without domatia, with the costa, secondary, and intersecondary veins prominulous above and below, the lesser venation reticulate and visible to slightly raised; petioles stout, 3–6 mm long; stipules with sheath 0.3–1 mm long, abruptly contracted to an awn 3–15 mm long. Inflorescences axillary and occasionally also terminal, 4.5–5 cm long, 4–7 cm wide, fascicled, ebracteate, peduncles 2–4 per axil, 12–28 mm long, cymes once or usually twice divided into 2–3 branches or pedicels, pedicels 6–18 mm long, filiform, flexuous; calyx limb with truncate tube 0.3–0.5 mm long, lobes 4, narrowly triangular, 0.6–1.5 mm long, acute; corollas funnelform, white to yellow, glabrous, tube 2–3 mm long, lobes 2.5–3 mm long, triangular to lanceolate. Fruiting pedicels markedly thickened distally; fruits subglobose, 6–7 mm long, 7–9 mm wide, smooth, becoming red to purple and then black.

Distribution and habitat. Amazonian Peru, in upland or seasonally flooded forest on sandy soils at 100–400 m, most frequently collected in primary forest.

Phenology. Collected in flower February, April, August, and October to December, in fruit January to May, July, August, and October to November.

This species is distinguished by its usually axillary inflorescences with relatively long flexuous pedicels, strongly flattened and costate internodes, and corollas with the tube shorter than or equal to the lobes. It is similar to *Faramea capillipes* Mueller Argoviensis in general aspect and inflorescence structure, and these species are probably closely related. *Faramea capillipes* differs from *F. vasquezii* in its slightly costate but generally rounded internodes, papyraceous to membranaceous leaf blades 5–12 cm long with 7–8 secondary veins, calyx limb with lobes 0.1–0.2 mm long, and corollas with lobes 5–6 mm long. This new species is also similar to *F. quadricostata* Bremekamp (emend. Steyermark, 1967), which shares a similar general

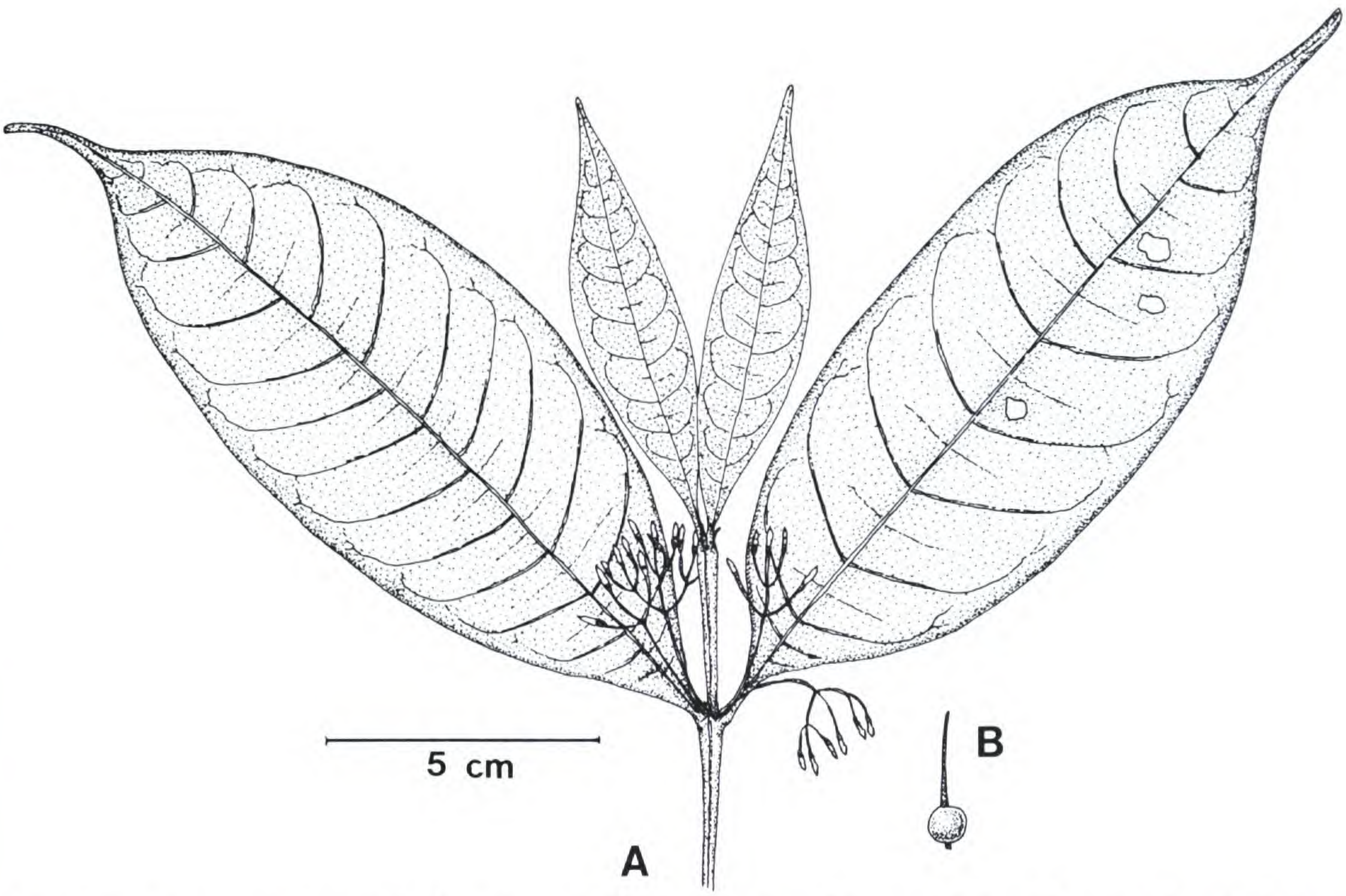

Figure 1. *Faramea vasquezii* C. M. Taylor.—A. Habit, drawn from *Vásquez 5710*. —B. Fruit with pedicel, drawn from *Vásquez 3974*. Both to same scale.

aspect and flattened costate internodes, but differs in its leaf blades 6–12 cm long, terminal inflorescences with peduncles 0–5 mm long, truncate calyx limb 1.3–1.5 mm long, and corollas with tubes 20–23 mm long and lobes 9.5–14 mm long.

This species is named in honor of Rudolfo Vásquez of the Missouri Botanical Garden, the accomplished Peruvian botanist who collected most of the material studied.

Additional collections examined. PERU. **Loreto:** Loreto, Nauta, río Marañón, 4°29′W, 73°33′W, *R. Vásquez & N. Jaramillo 3445* (AMAZ, MO); Maynas, Cahuide, río Itaya, *Vásquez & Jaramillo 5710* (AMAZ, MO, USM); Maynas, Amazonas, ExplorNapo and Explorama Camps, río Sucusari, ca. 3°15–30′S, 72°55′W, *Gentry et al. 27695* (MO), *31594* (MO), *74316* (MO), *Pipoly 14176* (AMAZ, MO), *Vásquez & Jaramillo 13111* (AMAZ, MO); Maynas, Iquitos, río Nanay, area of Mishana and Callicebus Biological Reserve, ca. 4°50′S, 73°30′W, *Davidson 5232* (MO), *Foster 4354* (MO), *Gentry et al. 31610* (MO), *Pipoly et al. 14915* (AMAZ, MO), *Solomon 3572* (MO), *Vásquez et al. 617* (AMAZ, MO, USM), *14196* (AMAZ, MO, USM); Maynas, Iquitos, near Puerto Almendras, ca. 3°45–50′S, 73°21–25′W, *Croat 19036* (MO), *Díaz & Jaramillo 275* (MO), *Revilla 2309* (MO), *Ruíz 1298* (MO), *Vásquez & Jaramillo 159* (AMAZ, MO, USM), *3974* (AMAZ, MO), *6246* (AMAZ, MO), *6516* (AMAZ, MO), *8658* (AMAZ, MO), *10192* (AMAZ, MO), *Vásquez & Soto 13732* (AMAZ, MO); Maynas, Pebas, río Ampiyacu, *Revilla 970* (MO); Ucayali, Sapuena, Jenaro Herrera CDJH-IIAP, 4°55′S, 73°45′W, *Vásquez et al. 12013* (MO). **Pasco:** Oxapampa, Palcazu Valley, Iscozach, 10°12′S, 75°15′W, *Foster 7974* (MO).

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Ancistrocladus korupensis (Ancistrocladaceae): A New Species of Liana from Cameroon

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ABSTRACT. *Ancistrocladus korupensis*, a species here described from the Southwest Province of Cameroon and adjacent Nigeria, is distinguished within the genus by sessile leaves, short petals, and long-winged fruits. The new species was investigated after michellamine B, a unique naphthyl isoquinoline alkaloid isolated from a sterile *Ancistrocladus* leaf collection, showed *in vitro* activity against HIV-1 and HIV-2. Subsequent collections showed that the liana was undescribed and apparently narrowly endemic to the Korup area.

Ancistrocladus Wallich (nom. conserv.) is a genus of 19 known species: 9 in tropical Asia (Dyer, 1874; Gagnepain, 1909; Craib, 1925; Steenis, 1948; Ramamoorthy, 1976; Harriman, 1987) and 10 in tropical Africa (Pellegrin, 1951; Hutchinson & Dalziel, 1954; Léonard, 1982, 1986). The resemblance of the winged fruits of *Ancistrocladus* spp. to those of the Dipterocarpaceae Blume has led some authors (e.g., Oliver, 1868; Dyer, 1874) to include the genus in the latter family. However, Gilg (1925) noted that the resemblance is strictly superficial and considered the Ancistrocladaceae Walpers (nom. conserv.) to be a monogeneric family in the Parietales. The results of anatomical (Metcalfe, 1952; Schmid, 1964; Gottwald & Parameswaran, 1968) and palynological (Erdtman, 1958) investigations support an affinity between Ancistrocladaceae and the endemic African family Dioncophyllaceae Airy Shaw; Cronquist (1981, 1988) treated the two as closely allied families of the Violales.

The Ancistrocladaceae are distinguished within the Violales (Cronquist, 1981) and among all of the dicotyledonous families of central Africa (Robyns, 1958) by the following diagnosis: plants lianas, not succulent, climbing by hooked apices of sympodial branches; leaves alternate (but often crowded in rosettes on flowering shoots), simple, entire, not sheathing at base, the blades symmetric; stipules present, very small and caducous; flowers in racemes, spikes, or dichotomously branched panicles; sepals 5, accrescent and winglike in fruit; petals distinct or slightly connate at base; extrastaminal corona lacking; stamens 5 or 10–15, erect in bud, the filaments slightly connate at base; ovary half-inferior, unilocular; ovule solitary, basilateral; fruit dry, indehiscent; endosperm present, ruminate. *Ancistrocladus* can sometimes be confused with the unrelated genus *Hugonia* L. (Hugoniaceae or Linaceae), but species of the latter genus can be vegetatively distinguished by the usually pale stems, leaves usually toothed, less crowded, and with numerous more prominent secondary veins, and hooks borne on normal branches.

Of the ten species of *Ancistrocladus* previously described from tropical Africa, six occur in the evergreen forests near the Atlantic coast from Gabon to Sierra Leone (Pellegrin, 1951; Hutchinson & Dalziel, 1954), three are apparently restricted to central and northern Zaïre (Léonard, 1982), and one is endemic to the Buda Forest of coastal Kenya (Léonard, 1986). The new species herein described is apparently endemic to the immediate vicinity of the Korup National Park in the Southwest Province of Cameroon, including the adjacent part of Cross River State of southeastern Nigeria.

Ancistrocladus korupensis D. W. Thomas & Gereau, sp. nov. TYPE: Cameroon. Southwest Prov.: Ndian Division, 0.6 km E of confluence of Mededibe (Moliba) and Ndian (Mana) Rivers, 90 m, 5°02′N, 8°53′E, 4 Mar. 1993, *Gereau, Thomas, F. Namata & E. Jato 5180* [infructescences and fallen fruits] (holotype, MO; isotypes, K, P, SCA, YA). Figure 1.

Plantae omnino glabrae. Caules adulti parce ramosi; ramis principalibus elongatis, rectis subcurvatisve; ramis lateralibus extra-axillaribus, uncos gerentibus. Folia adulta sessilia, ex formis duabus constantia: folia ramorum principalium remote disposita, ex ellipticis oblonga, basi cuneata, apice rotundata, venis secundariis paucijugis; folia

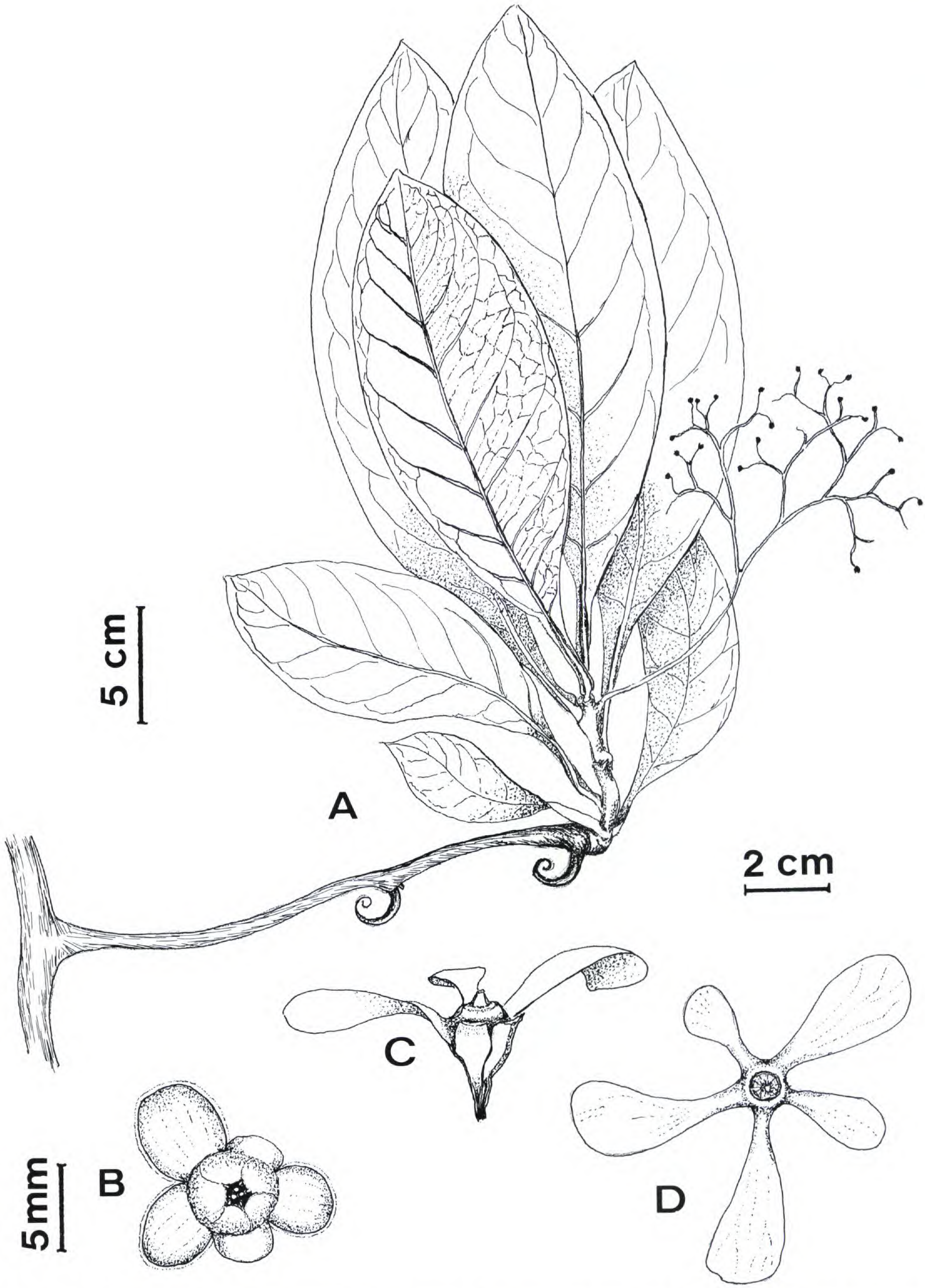

Figure 1. *Ancistrocladus korupensis* D. W. Thomas & Gereau. —A. Lateral branch with rosette leaves and inflorescence. —B. Flower. —C, D. Fruit. Based on: A, B, *Jato s.n.* (Nov. 1992); C, D, *Gereau et al. 5177.*

ramorum lateralium in rosulas apicales crebra, oblanceolata, (8–)14.5–33.1 × (2.9–)4.6–8.5 cm, basi ex anguste cuneatis ad longe cuneata, apice ex acutis rotundata, margine prope basim valde revoluta, sursum nonnihil revoluta, venis secundariis paribus 8–18 dispositis, brochidodromis; foliorum omnium costa infra prominente, in herbario supra parum impressa, venis secundariis utrinque prominulis, venis tertiariis tenue reticulatis. Inflorescentia ex panicula dichotoma laxa inter rosulas foliorum portata constans; pedunculo extra-axillari, (4–)5.5–9.8 cm longo; pedicellis 6.5–8.5 mm longis, sub calyce ca. 2 mm articulatis. Flores sepalis ex suborbicularibus oblongis, manifeste dimorphis, majoribus tribus ca. 5 × 4 mm, minoribus duobus ca. 2.5 × 3.5 mm, basi truncatis, apice rotundatis, sub anthesi ad ovarii basim breve decurrentibus; petalis suborbicularibus quam sepalis brevioribus, prope basim convexis incrassatisque; staminibus 10 in verticillos duos dispositis, filamentis validis, internis ca. 1 mm longis, externis perbrevibus, antheris ca. 1 mm longis; stylis 3, distinctis, ca. 2 mm longis, distaliter incrassatis. Fructus hebetate brunneus; sepalis tenuibus, inaequalibus, majoribus spathulatis 3.4–4.8 × 1.3–2.1 cm, minoribus ex anguste oblongis spathulatis 1.1–2.8 × 0.5–1.1 cm, alarum marginibus 5 ad basim fructus decurrentibus costas prominentes 5 formantibus; fructus corpu turbinato, receptaculo supra alas inflato tholiformique; styli basi persistente accrescente conica; pericarpio crasso sicco coriaceo; semine diametro ca. 8 mm.

Plants glabrous throughout. Saplings unbranched or very sparingly branched, to 4 m high, lacking hooked lateral branches; sapling leaves long-lived, in dense terminal rosettes, 38.8–75.1 × 11.0–13.8 cm (L/W = 3.5–5.4), the secondary veins in 25–32 pairs; saplings becoming lianas by branching from lateral bud some distance below leaf rosette, this "main branch" long and scandent, bearing hook-producing lateral branches. Adult stems climbing to 20 m, to 10.4 cm maximum diameter, sparingly branched, not normally rooting when in contact with ground, terete, with outer bark purplish brown, inner bark red and fibrous; main branches elongate, straight or somewhat curving, not twining; lateral branches extra-axillary, to ca. 50 cm long, bearing 1–several hooks in a single plane. Adult leaves sessile, of 2 kinds: leaves of main branches widely spaced, elliptic to oblong (ca. 12 × 5 cm in type), cuneate at base, rounded at apex, with as few as 7 pairs of secondary veins; leaves of lateral branches crowded in rosettes produced near apex of current year's growth and persisting up to three years, oblanceolate, (8–)14.5–33.1 × (2.9–)4.6–8.5 cm (L/W = 2.9–4.2), narrowly cuneate to long-attenuate at base, acute to rounded at apex, the margin strongly revolute near base, somewhat revolute distally, the secondary veins in 8–18 pairs, brochidodromous, forming an intramarginal vein 2–4 mm from margin; all leaves drying dull dark green above, yellow-green beneath, the midrib extending to apex, terminating in a gland, prominent beneath, slightly impressed above in herbarium specimens, the secondary veins prominulous on both surfaces, shortly decurrent on midrib, the tertiary veins finely reticulate, rather obscure. Inflorescence a lax, dichotomously branched panicle, borne among leaf rosettes, sometimes bearing hooks; peduncle extra-axillary, (4–)5.5–9.8 cm; pedicels 6.5–8.5 mm long, articulated ca. 2 mm below calyx. Flowers with sepals suborbicular to oblong, distinctly dimorphic, the larger three ca. 5 × 4 mm, the smaller two ca. 2.5 × 3.5 mm, pale yellow-green with fine brownish veins, truncate at base, rounded at apex, shortly decurrent on base of ovary at anthesis; petals suborbicular, shorter than sepals, pale yellow, entire, convex and thickened toward base; stamens 10 in 2 whorls, the filaments stout, those of inner stamens ca. 1 mm long, those of outer stamens very short, the anthers ca. 1 mm long with thecae separated by well-developed connective; styles 3, distinct, ca. 2 mm long, distally thickened, each terminating in a broad flattened stigma. Fruit dull brown; sepals thin, dry, brittle, unequal, the larger spathulate, 3.4–4.8 × 1.3–2.1 cm, the smaller narrowly oblong to spathulate, 1.1–2.8 × 0.5–1.1 cm, with both margins of smaller wings and one margin of one larger wing decurrent on base of fruit, forming 5 prominent ribs; fruit body turbinate, broadest at level of wings with diameter of 1.0–1.2 cm, the receptacle inflated and domelike above wings; scars of fallen petals and stamens forming a pale annulus 1–2 mm above wings; style base persistent, enlarged, conical; pericarp thick, dry, coriaceous; seed ca. 8 mm diam., with cerebriform-ruminate endosperm evident through thin testa; germination epigeal in moist litter layer, the cotyledons remaining inside fruit.

The following preliminary key serves to distinguish *Ancistrocladus korupensis* from the other species of *Ancistrocladus* in Africa:

1a. Adult leaves pseudopetiolate ..... *A. abbreviatus* Airy Shaw, *A. barteri* Scott-Elliot, *A. congolensis* J. Léonard, *A. ealaensis* J. Léonard, *A. letestui* Pellegrin, *A. uncinatus* Hutchinson & Dalziel

1b. Adult leaves sessile.

2a. Petals equaling or longer than sepals ..... *A. guineensis* Oliver, *A. pachyrrhachis* Airy Shaw, *A. robertsoniorum* J. Léonard, *A.* sp. nov. ined. [*Cheek & Ndumbe 3915*, *Thomas 9016*]

2b. Petals shorter than sepals.

3a. Longer sepals 3.4–4.8 cm long in fruit ..... *A. korupensis*

3b. Longer sepals 0.8–1.2 cm long in fruit ..... *A. likoko* J. Léonard

Additional material examined. CAMEROON. **Southwest Prov.:** Ndian Div., ca. 10 km NW of Mundemba on Ekundu Kundu Rd., in disturbed primary forest on sandy clay soil, 90 m, 5°01′N, 8°52′E, 28 Feb. 1993, *Gereau et al. 5172* [sterile] (K, MO, P, SCA, YA); Korup

National Park, Science Camp 1, 50 m, 5°01′N, 8°48′E, 1 Mar. 1993, *Gereau et al. 5175* [fallen fruits and infructescences] (K, MO, P, SCA, YA); 1.2 km E of Science Camp 1 on trail to Ndian (Mana) River, 80–100 m, 5°02′N, 8°49′E, 1 Mar. 1993, *Gereau et al. 5177* [fallen fr & infr] (K, MO, P, SCA, YA); type locality, 4 Mar. 1993, *Gereau et al. 5179* [sterile sprouts from fallen stem] (K, MO, P, SCA, YA); type locality, 4 Mar. 1993, *Gereau et al. 5181* [seedlings] (K, MO, P, SCA, YA); near S bank of Six Cup Garri Creek less than 1 km E of confluence with Ndian (Mana) River, 90 m, 5°03′N, 8°53′E, 7 Mar. 1993, *Gereau et al. 5200* [sterile sapling] (K, MO, P, SCA, YA); Korup National Park, ca. 2 km N of Ikassa Last Bush, 60 m, 4°57′N, 8°50′E, 9 Mar. 1993, *Gereau et al. 5203* [fallen fr] (K, MO, P, SCA, YA); ca. 10 km NW of Mundemba on Ekundu Kundu Rd., 90 m, 5°01′N, 8°52′E, 10 Mar. 1993, *Gereau & Thomas 5204* [flowers and buds from sapling flowering out of season] (K, MO, SCA, YA); forest ca. 6 km NW of Mundemba, 70 m, 5°01′N, 8°53′E, Nov. 1992, *Jato s.n.* [fls] (MO); Korup National Park, primary rainforest, 60 m, 5°02′N, 8°50′E, 28 Mar. 1987, *Thomas 6889* [sterile] (MO, YA), Mar. 1991, *Thomas 8505* [sterile] (MO); forest ca. 6 km NW of Mundemba, 60–70 m, 5°01′N, 8°53′E, Apr. 1992, *Thomas 9020* [old infr] (K, MO, P, SCA, YA). NIGERIA. **Cross River State:** Oban, *Talbot 1726* [sterile] (BM).

Physical Environment

The area in which *Ancistrocladus korupensis* is known to grow supports closed-canopy evergreen forest with areas of secondary growth following human disturbance (Gartlan et al., 1986). The area lies at 50–100 m above sea level and is flat to gently undulating with numerous small creeks in shallow valleys. There are occasional outcrops and boulders of the hard, acidic metamorphic rocks of the African basement complex. The autochthonous soils are highly acidic (pH ca. 3.9–4.5), leached, and infertile, with a high to very high sand content (60–91%) and the clay fraction greatly depleted near the surface. The rainfall pattern is pseudo-equatorial, with only a single wet and dry season rather than the two wet and two dry seasons found further south. Rainfall at the nearby Ndian oil palm plantation averaged 5,460 mm annually in the period 1963–1983. The single long wet season peaks in July–September; November–March is the dry season, with January the driest month. There is little annual variation in mean temperatures.

Vegetation

Letouzey (1985) classified the vegetation of the area as Atlantic–Biafran evergreen forests, rich in Caesalpiniaceae. This forest type is widespread at low elevations near the coast in Cameroon; however, the forest on low-lying sandy clay soils in which *Ancistrocladus korupensis* occurs has a unique and distinctive vegetation.

Ancistrocladus korupensis occurs in forests of well-defined physical structure with a high degree of local endemism. Common or locally dominant trees of the upper canopy include *Afzelia bipindensis* Harms, *Berlinia bracteosa* Bentham, *Didelotia africana* Baillon, *Erythrophloeum ivorense* A. Chevalier, *Julbernardia seretii* (DeWildeman) Troupin, *Microberlinia bisulcata* A. Chevalier, *Tetraberlinia bifoliolata* (Harms) Hauman (Caesalpiniaceae), *Lecomptedoxa klaineana* (Pierre ex Engler) Dubard (Sapotaceae), and *Lophira alata* Banks ex Gaertner (Ochnaceae). The lower canopy is dominated by *Oubanguia alata* Baker f. (Scytopetalaceae), apparently common only in the Korup area; other common smaller trees include *Dichostemma glaucescens* Pierre, *Klaineanthus gaboniae* Pierre ex Prain, *Mareyopsis longifolia* (Pax) Pax & K. Hoffmann (Euphorbiaceae), *Diogoa zenkeri* (Engler) Exell & Mendonça, *Strombosia pustulata* Oliver (Olacaceae), *Diospyros gabunensis* Gürke (Ebenaceae), *Hymenostegia afzelii* (Oliver) Harms (Caesalpiniaceae), and *Tabernaemontana brachyantha* Stapf (Apocynaceae). The genus *Cola* Schott & Endlicher (Sterculiaceae) is well represented in the understory, which is dominated by *C. semecarpophylla* K. Schumann, a monocaulous tree with rosettes of very large leaves; *C. cauliflora* Masters, *C. lateritia* K. Schumann, *C. megalophylla* Brenan & Keay, and *C. rostrata* K. Schumann are also common. *Deinbollia unijuga* D. W. Thomas (Sapindaceae) appears to be limited to the same area as *A. korupensis*, and additional narrow endemics to be described from Korup collections include new species of *Corymborkis* Thouars (Orchidaceae), *Uvariopsis* Engler (Annonaceae), and *Vepris* Commerson ex A. Jussieu (Rutaceae).

The area is rich in species of lianas. *Ancistrocladus guineensis* occurs in the same area as the new species, while *A. abbreviatus* is common in nearby seasonally flooded forests. *Ancistrocladus letestui* occurs on nearby hills, while *A. uncinatus* is known only from Cross River State, Nigeria, adjacent to the Korup area. Other climbers include many species in the genus *Strychnos* L. (Loganiaceae) and in the families Annonaceae, Apocynaceae, Connaraceae, Fabaceae, Icacinaceae, and Menispermaceae.

Collecting History and Phytochemistry

Ancistrocladus korupensis was apparently first collected near Oban in the Cross River State of southeastern Nigeria (*Talbot 1726*, BM); this sterile specimen was identified only as *Ancistrocladus* sp. The second collection, *Thomas 6889* (MO, YA), was collected in 1987 in the Korup National Park,

probably about 50 km from Talbot's locality; this collection, also sterile, was tentatively identified as the widespread species *A. abbreviatus*. The Thomas collection was a voucher for a 0.5-kg sample of dried stems and leaves, collected under Contract No. N01-CM-67923 between the Missouri Botanical Garden and the Developmental Therapeutics Program of the United States' National Cancer Institute (N.C.I.). Extracts of this sample tested for *in vitro* biological activity were found to inhibit the destruction of cultured human lymphocytes by both HIV-1 and HIV-2 (Manfredi et al., 1991).

Before it was realized that a new species was involved, the new alkaloids that inhibit HIV had been isolated and named michellamine A and B. These are apparently dimers of other naphthyl isoquinoline alkaloids (Bringmann, 1986) previously identified from the genus (references in Léonard, 1982, 1986). At this point, the N.C.I. requested more material for further testing; samples of *A. abbreviatus* from Gabon, however, showed no inhibitory activity against HIV. When the original population from which the biologically active samples had been taken was relocated in Korup, it became clear that the plants belonged to a new species, apparently narrowly endemic to the Korup area. With the discovery of flowers and fruits, we have been able to complete the description of this species; the initial impetus for this task came from the plant's pharmaceutical potential.

Acknowledgments. We thank Wendy Madar and Mary Bucy for the illustration. Special thanks are due to the Jato family: Johnson Jato, who provided hospitality in Yaoundé and transportation to Korup and obtained all necessary permits; and Emmanuel Jato, who tirelessly pursued the liana and finally collected its flowers and fruits. Staff of the WWF/Cameroon Government's Korup Project provided extensive assistance and field expertise. In particular, we thank J. S. Gartlan (WWF Cameroon representative), Paul Symonds (Korup Project Manager), and Ferdinand Namata (Park Guide). Finally, we thank Gordon W. Cragg of the N.C.I. for his enthusiastic support and encouragement during seven challenging years of collaboration. This work was supported in part by N.C.I. Contracts Nos. N01-CM-67923 and N01-CM-17547.

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Una Nueva *Haploclathra* (Clusiaceae) de la Amazonía Peruana

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RESUMEN. El género *Haploclathra*, hasta la fecha era desconocido de Perú; pero recientes colecciones en la Región Loreto, han reportado que se encuentra representado por dos especies: una es *Haploclathra paniculata* var. *paniculata*, conocida de Brasil; y la otra es *Haploclathra cordata*, nombre que se propone porque las hojas con base subcordada y el tamaño de las inflorescencias y de los frutos indican que se trata de una nueva especie.

ABSTRACT. Heretofore, the genus *Haploclathra* was not known from Peru, but recent collections from the Loreto Region have indicated that in fact two species are represented. One, *Haploclathra paniculata* var. *paniculata*, is known from Brazil, and the other, *Haploclathra cordata*, is a new species described and illustrated herein.

El género *Haploclathra* es conocido de la Amazonía de Brasil y de Perú: *Haploclathra cordata*, por ahora reportada de Perú, Loreto, Requena, Jenaro Herrera; *Haploclathra grandiflora*, conocida sólo del tipo, Brasil, Amazonas, Taracua en el río Uaupés; *Haploclathra leiantha*, en Brasil, Amazonas, río Curicuriary afluente del alto río Negro; Manaos, río Tarumá; *Haploclathra paniculata* var. *paniculata*, reportada de Brasil, Amazonas, alto y bajo río Negro, Manaos, y de Perú, Loreto, Iquitos; *Haploclathra paniculata* var. *verticillata*, de Brasil, Amazonas, alto río Negro.

CLAVE PARA LAS ESPECIES DE *HAPLOCLATHRA* (ADAPTADA DE LLERAS, 1972)

1. Botones < 10 mm de largo, pétalos glabros 2
1. Botones > 12 mm de largo, pétalos pubescentes o puberulentos en la porción expuesta 3
2(1). Pecíolos 2–3 mm, base foliar subcordada; anteras 2 mm de largo; cápsula 16 × 11 mm ..... *Haploclathra cordata*
2. Pecíolos 10–35 mm de largo, base foliar aguda a obtusa; anteras 3–5 mm de largo; cápsula 20–30 × 8–13 mm .... *Haploclathra leiantha*
3(1). Hojas 30 cm de largo; pétalos > 30 mm de largo ..... *Haploclathra grandiflora*
3. Hojas < 28 cm de largo; pétalos < 20 mm de largo 4
4(3). Hojas opuestas o subopuestas ..... *Haploclathra paniculata* var. *paniculata*
4. Hojas verticiladas ..... *Haploclathra paniculata* var. *verticillata*

ESPECIES DE *HAPLOCLATHRA* DE LA AMAZONÍA DE PERU

Haploclathra paniculata var. **paniculata**
Haploclathra paniculata (Martius) Bentham, J. Linn. Soc. Bot. 5: 58. 1861.

Especímenes examinadas. PERU. **Loreto:** Provincia de Maynas, Distrito de Iquitos, Puerto Almendras, bosque primario, suelos con arena blanca y drenaje deficiente, *Vásquez 9637*, *9660*, *10158* (AMAZ, MO, USM).

Haploclathra cordata, sp. nov. TIPO: Perú. Loreto: Provincia de Requena, Distrito de Jenaro Herrera, Jenaro Herrera, bosque primario (suelos arenosos, con humedad permanente) "varillal," 12 Nov. 1987, *Vásquez 9996* (holótipo, AMAZ; isótipos, F, G, MO, USM). Figura 1.

Arbor 24 m alta, ramulis inferne glabris, superne puberulis. Folia decussata, petiolus 2–3 mm longo, coriacea, oblonga vel elliptica, revoluta, apice rotundata, basi subcordata, supra glabra, infra glabra, in nervo puberula, 3–5(–8) cm longa, 2–3(–5) cm lata. Inflorescentia terminalis paniculata ferrugineo-puberula, floribus minutis; sepala 2 mm longa, petala alba, 7 mm longa. Capsula ovata vel oblique ovata, glabra, 1.6 cm longa.

Arbol 24 m de alto. Látex marrón claro. Ramitas teretes y glabras, pero cerca de la inflorescencia tetrágono-comprimidas, ferrugíneo-puberulentas. Hojas decusadas; pecíolo puberulento 2–3 mm de largo; limbo coriáceo con el borde revoluto, oblongo a elíptico, 3–5(–8) × 2–3(–5) cm, ápice redondeado a obtuso, base subcordada, haz glabro, envés también glabro excepto el nervio medio, que es puberulento, 10–14 pares de nervios secundarios, emergentes en el envés, venación terciaria subparalela conspicua. Inflorescencia terminal, panícula ferrugíneo-puberulenta, 9 cm de largo; pedicelos 2 mm de largo; brácteas lanceoladas 5 mm de largo, 2 mm en la base, pubérulas por fuera y glabras por dentro, caducas; bractéolas opuestas, lineares, pubérulas por fuera y glabras por dentro, 3 mm de largo, 1 mm en la base; botón floral ovoide de 5 mm de largo. Sépalos 5 deltiformes, pubérulos por

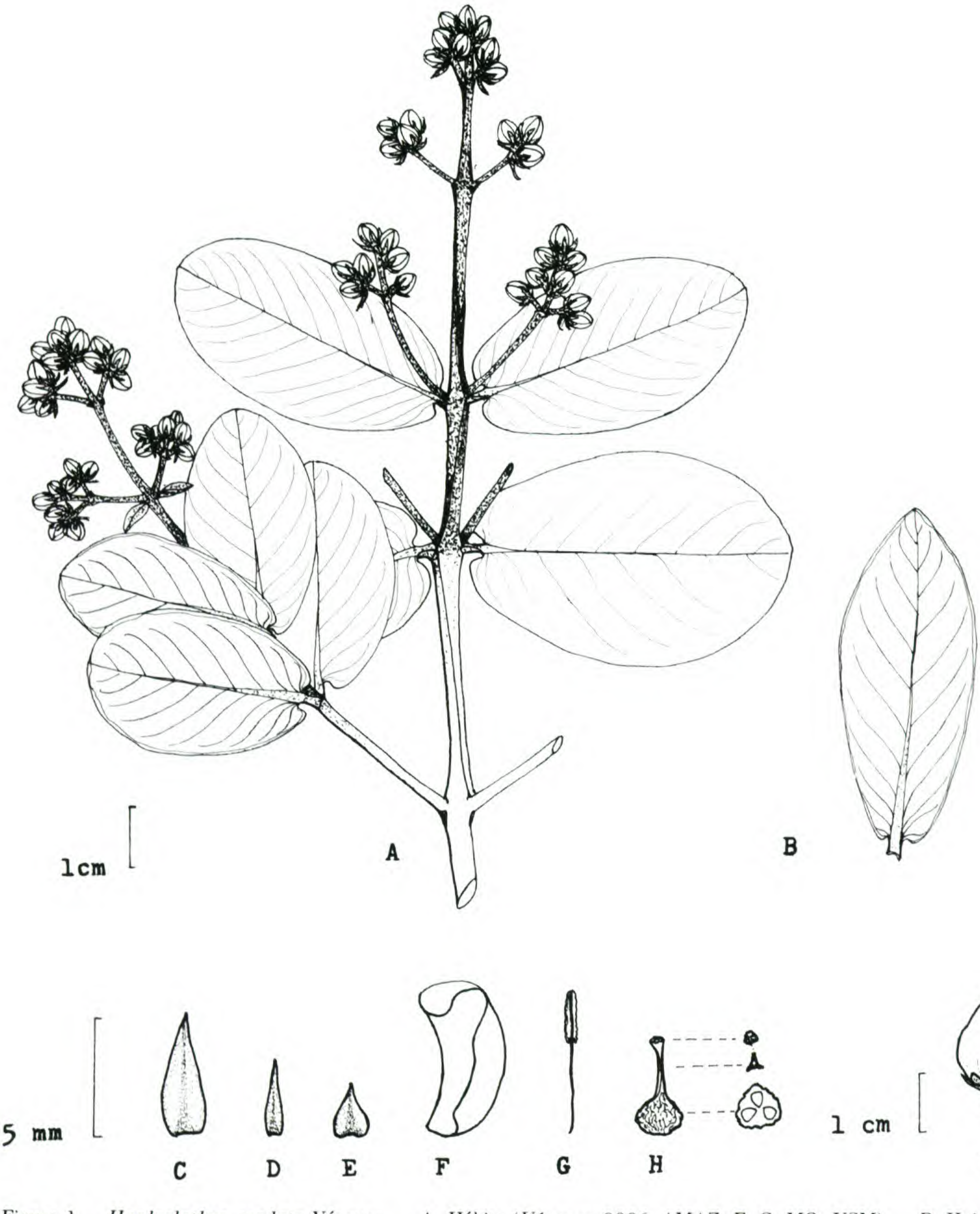

Figura 1. *Haploclathra cordata* Vásquez. —A. Hábito (*Vásquez 9996*, AMAZ, F, G, MO, USM). —B. Hoja de árbol juvenil. —C. Bráctea. —D. Bractéola. —E. Sépalo. —F. Pétalo. —G. Estambre. —H. Gineceo. —I. Fruto.

fuera y glabros por dentro, 2 mm de largo, 1.5 mm en la base; pétalos 5, libres, blancos, glabros en ambos lados, 7 × 3 mm. Estambres numerosos, con filamentos 2–4 mm de largo; anteras lineares, 2 mm de largo, subcordadas en la base; tecas onduladas, con dehiscencia longitudinal. Ovario glabro, rugoso, 1.5 mm de alto por 2 mm diám., tricarpelar, trilocular, con placentación axial, 1 o 2 óvulos por lóculo; estilo 2.5 mm de largo con la sección transversal fuertemente triangular. Cápsula ovoide u ovoide-oblicua, con la superficie glabra y ligeramente rugosa, 1.6 cm de largo, 1.1 cm de diám.; cáliz persistente; generalmente con una semilla por fruto; exocarpo no separable del endocarpo.

Ecología. Bosque primario no inundable, por aguas de los ríos; pero con humedad casi permanente por el drenaje deficiente del suelo, el cual es esencial-

mente constituido por arena blanca; la infertilidad hace que esta especie se comporte como gregaria formando un bosque llamado "varillal." Florece en noviembre; fructifica en marzo.

Nombres vernaculares. Localmente se le conoce con los nombres siguientes: "Balatillo" y "Boa caspi."

Usos. Es la madera más usada para la construcción de viviendas en la localidad de Jenaro Herrera.

Esta especie tiene sépalos pubérulos, pétalos y ovario glabros, con dimensiones más o menos como *Haploclathra leiantha;* pero difiere de ésta por tener inflorescencias y cápsulas más pequeñas; y también porque las hojas tienen pecíolo corto y limbo con la base subcordada, que es un carácter inusual en el género.

Parátipos. PERU. **Loreto:** Provincia de Requena, Distrito de Jenaro Herrera, Jenaro Herrera, *Vásquez 7664* (AMAZ, MO, USM); *Valcarsel s.n.* (AMAZ, G, USM).

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A New Species of *Ceratozamia* (Zamiaceae) from Querétaro and Hidalgo, Mexico

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ABSTRACT. A new species, *Ceratozamia sabatoi*, is described and illustrated. Its closest affinities are with *C. kuesteriana* from Tamaulipas, but it differs from that species in both cone and leaf morphology. The chromosome number of *Ceratozamia sabatoi* is $2n = 16$, and the karyotype is similar to other species of the genus.

During botanical explorations and ecological impact studies in the area that will be affected by the Zimapan hydro-electric dam project, a small-trunked *Ceratozamia* was found in pine-oak forest by Ricardo Zirahuén, a biologist collaborating with the aforementioned project in the state of Querétaro. This taxon also appears in an adjacent population in mixed oak forest on the Hidalgo side of the border at a similar elevation.

Following further expeditions to both localities to procure live, vegetative, and fertile material to establish at the Jardín Botánico Clavijero (Botanic Garden of the Instituto de Ecología) for observation, it was concluded that this species is new to science. It is compared to *Ceratozamia kuesteriana* Regel, with which it is closely related, but differs in habit, leaf, female cone characteristics, and the light green color of emergent leaves.

Ceratozamia sabatoi Vovides, Vázquez Torres, Schutzman & Iglesias, sp. nov. TYPE: Mexico. Querétaro: 15 Apr. 1991, *A. P. Vovides 1205* female (holotype, XAL). Figure 1.

Truncus globosus ad cylindricum, hypogaeus vel semihypogaeus, humilis ad 25 cm altus; cataphylla lanata, triangularia 4.55 cm longa, basi 2.5–3.5 cm lata; folia pauca, usque 6 pinnate, glabra; petiolus subteres vel cylindricus, 25–45 cm longus, parte infima dilatatus, validis spinis armatus; rachis semiteres in dimidio inferiore paucis spinis armata, supra fere inermis vel inermis, in cuspidem 5–11 mm longem excurrens; foliola subopposita vel alterna, 15–35 juga, remota linearis, 12–25 longa, 1.2–2.4 cm lata, basi cuneata, apicem symetrice, cuspidata, margine integerrima, 9–14 ($\bar{x}$ = 12)nervis; strobilus masculinus lineari-cylindricus 12–20 cm longus, 2–2.4 cm latus; pedunculus tomentosus 6–14 cm longus, 0.8–1 cm latus; strobilus femeninus cylindricus 8–10 cm longus, 4–6 cm latus; pedunculus tomentosus 4–8 cm longus, 4–5.5 cm latus; semina 1.5 longa, 1.3 cm lata; $2n = 16$.

Small palmlike plants; trunk partly subterranean, globose, readily producing offshoots, becoming cylindrical with age up to 25 cm long, 17.5 cm diam. protected with persistent leaf bases, dark brown in color. Leaves 2–6, pinnate, spirally arranged forming an open crown, up to 80 cm long, 52 cm wide; petiole and rachis ascending to horizontal, armed with short stout prickles, 0.08–0.4 cm long ($\bar{x}$ = 0.15, n = 40), petiole tomentose at base. Leaflets 12–136 ($\bar{x}$ = 69, n = 33 leaves) lanceolate, narrowly obovate to subulate, glabrous, margin entire, subrevolute, apex pungent, base attenuate, dark to light green on adaxial surface, lighter green on abaxial, 9–29 cm long ($\bar{x}$ = 17, n = 47), 0.7–2.4 cm wide ($\bar{x}$ = 1.2, n = 47); articulation zone 0.2–0.5 cm wide ($\bar{x}$ = 0.35, n = 43), venation ± visible on adaxial surface, more prominent on abaxial, number of veins 9–14 ($\bar{x}$ = 12, n = 20), distance between veins 0.75–1.4 mm. Microstrobili green when immature becoming light to dark brown at dehiscence, 6.5–23 cm long ($\bar{x}$ = 15.8), 1.9–3 cm diam. ($\bar{x}$ = 2.3); peduncle tomentose, 1.5–11 cm long ($\bar{x}$ = 6.3), 0.5–1 cm diam. ($\bar{x}$ = 0.7, all measurements

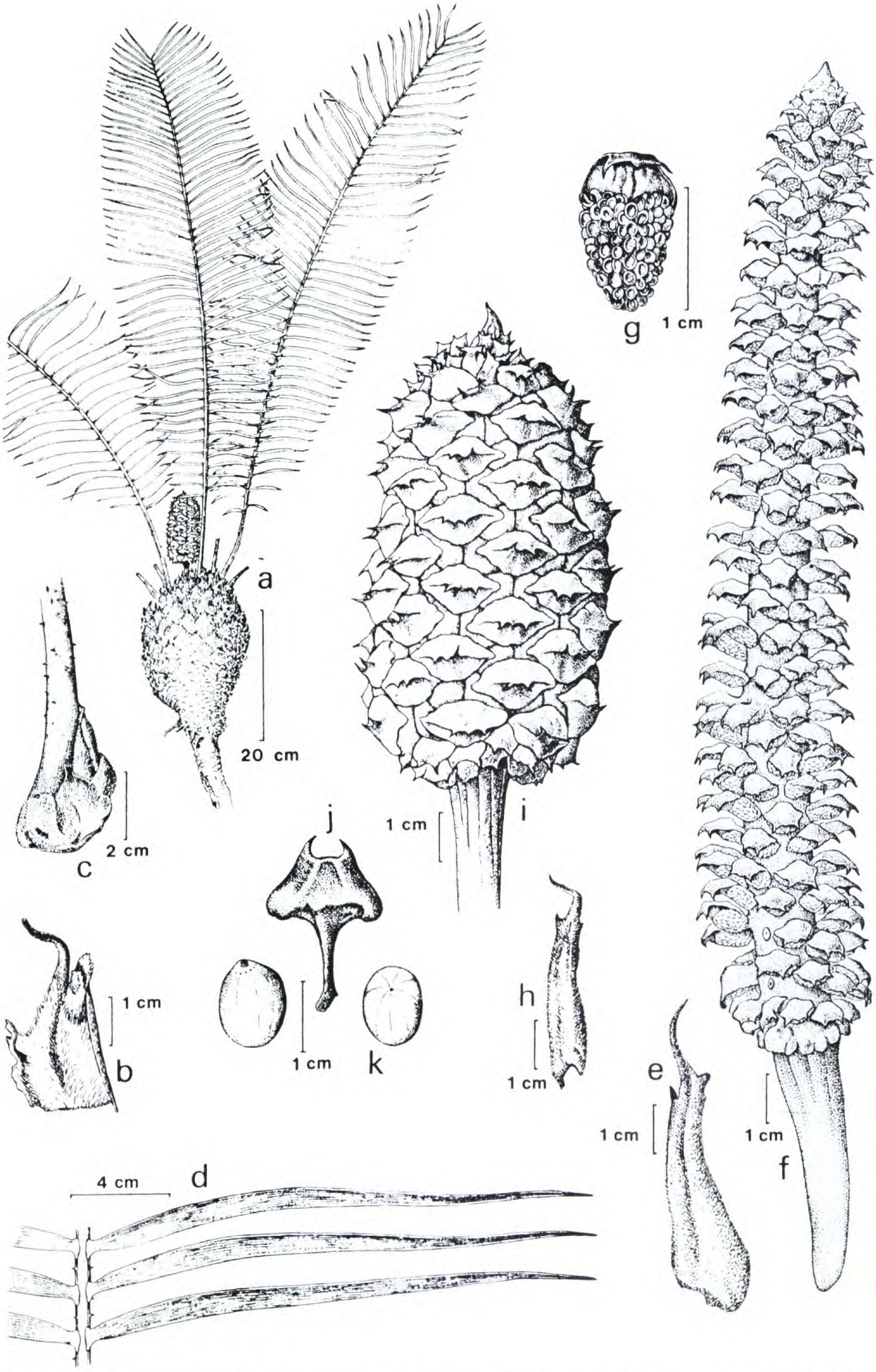

Figure 1. a–k, *Ceratozamia sabatoi* Vovides, Vázquez Torres, Schutzman & Iglesias. —a. Habit of plant. —b. Leaf cataphyll. —c. Base of petiole. —d. Detail of leaflets and rachis. —e. Male cone cataphyll. —f. Male cone at dehiscence. —g. Microsporophyll. —h. Female cone cataphyll. —i. Mature female cone. —j. Megasporophyll. —k. Seeds.

Figure 2. Diploid idiogram of *Ceratozamia sabatoi* ($2n = 16$), bar = 2 μm.

n = 6); microsporophylls numerous, spirally arranged forming apparently vertical rows, cuneiform, bicornate at distal end, fertile portion covering ½–⅔ of abaxial surface excluding horns and stalk, 0.9–1.4 cm long ($\bar{x}$ = 1.1), 0.4–0.7 cm wide ($\bar{x}$ = 0.6, n = 6); microsporangia numerous in sori of 2 to 3, dehiscence by longitudinal slit, 0.9–1.3 mm diam. ($\bar{x}$ = 1.1, n = 12). Megastrobili cylindrical to barrel-shaped slightly tapering toward apex, light blue-green when immature, turning green to light blue-brown at maturity, 6.0–12 cm long ($\bar{x}$ = 9.5), 3.4–5.6 cm diam. ($\bar{x}$ = 4.8); peduncle tomentose, 2.0–10 cm long ($\bar{x}$ = 5.4), 0.6–1.3 cm diam. ($\bar{x}$ = 0.8); megasporophylls numerous, spirally arranged forming apparently vertical rows, cuneiform-peltate, distal ends hexagonal, thickened, bicornate, with reddish tomentum near horns, 1.7–2.6 cm long ($\bar{x}$ = 2.1), 1.1–2.8 cm wide ($\bar{x}$ = 1.7, all measurements n = 7). Seeds ovate variably angulate, sarcotesta creamy-white when immature becoming blue-green to light brown when mature, sclerotesta light beige, smooth, 8–10 visible ridges radiating from micropyle, 1.3–1.9 cm long ($\bar{x}$ = 1.5), 1.1–1.4 cm diam. ($\bar{x}$ = 1.3, n = 6). Chromosome number $2n = 16$.

We assign the specific epithet in honor of the late Sergio Sabato, distinguished professor at the University of Naples, Italy, for his outstanding and prolific fieldwork and experimental biology on neotropical Zamiaceae.

Paratypes. MEXICO. **Querétaro:** 15 Apr. 1991, *A. P. Vovides, K. Norstog & P. Fawcett 1200, 1201, 1202, 1204,* all ♀, *1190, 1191, 1192, 1194* all ♂ (XAL). **Hidalgo:** 12 Feb. *1991, A. P. Vovides, M. Vázquez T. & C. Iglesias 1156, 1157, 1158, 1159, 1160* all ♀, *1161, 1162, 1163, 1164, 1165, 1166, 1168, 1169, 1170, 1171, 1172, 1173, 1175, 1176, 1177, 1178, 1179, 1180, 1181, 1182, 1183, 1184, 1185, 1186* all ♂ (XAL).

The following key permits the separation of *Ceratozamia sabatoi* from *C. kuesteriana* and *C. microstrobila.*

Diagnostic Key

1a. Median leaflet width greater than 2.8 cm, persistent leaf bases light brown, tightly appressed to trunk ..... *C. microstrobila*

1b. Median leaflet width less than 2.8 cm, persistent leaf bases dark brown, not appressed to trunk
  2a. Petiole and rachis coppery in adult leaves; leaflets falcate to subfalcate, linear-lanceolate; veins 6–9; megastrobili reddish-brown to dark green, longer than 13cm ..... *C. kuesteriana*
  2b. Petiole and rachis light to dark green in adult leaves; leaflets not falcate to subfalcate, not linear-lanceolate; veins 9–14; megastrobili blue-green to blue-brown, less than 13cm long ..... *C. sabatoi*

Chromosomal Studies

The chromosome number and karyotype were determined from three established specimens held at the Jardin Botánico Fco. J. Clavijero under the accession numbers: 91-028, 91-040, 91-041 and vouchers deposited at (XAL). The root tip mitosis technique was used described by Vovides (1983) and chromosome classification based on centromere position that of Levan et al. (1964) modified by Schlarbaum and Tsuchiya (1984). The diploid idiogram (Fig. 2) was constructed by taking the average arm lengths of the best three metaphase cells examined (Fig. 3). Arm lengths, total chromosome length, chromosome index (short arm divided by long arm), and symmetry index (length of longest pair divided by length of shortest pair) were computed using the average arm lengths from the three metaphase cells (Table 1). The karyotype shows 11 median region (m) chromosomes, 1 submedian (sm) chromosome, 1 subterminal region (st) chromosome, and 2 terminal point (T) chromosomes. Satellite number and position vary with cells observed and a maximum of 5 satellites were recorded, but not considered in the calculations.

Habitat

The vegetation at the Querétaro locality is mainly pine-oak forest dominated by *Pinus teocote* Schlechtendal & Chamberlain, *Quercus crassifolia* Humboldt & Bonpland, *Q. macrophylla* Martius & Galeotti, *Q. germana* Chamberlain & Schlechtendal, and *Q. xalapensis* Humboldt & Bonpland on reddish clay (laterite) soils. The vegetation of the Hidalgo locality, a mixed oak forest, appears much richer due to higher rainfall. The dominant tree species are; *Arbutus xalapensis* Humboldt, Bonpland & Kunth, *Buddleja cordata* Humboldt, Bonpland & Kunth, *Carya ovata* (Miller) K. Koch, *Litsea glaucescens* Humboldt, Bonpland & Kunth, *Meliosma alba* (Schlechtendal) Walpers, *Persea* sp., *Prunus serotina* Ehrenberg, *Quercus germana* Chamberlain & Schlechtendal, *Q. sartorii* Liebmann, *Q. polymorpha* Schlechtendal & Chamberlain, and *Q.*

Figure 3. Chromosomes of *Ceratozamia sabatoi* at mitotic metaphase, bar = 2 μm.

xalapensis Humboldt & Bonpland. The soil is a dark humus-rich clay on limestone.

Discussion

Precise information on localities has been purposely omitted in order to discourage indiscriminate commercial collecting, which could lead to the extinction of this endangered species.

Even though some vegetative characteristics, especially the leaves, show on occasion morphological similarities between *Ceratozamia kuesteriana* and *C. sabatoi*, the consistent differences in cones, emergent leaves, seeds, and habitat lead us to consider the two taxa as separate species. Geographically speaking, several species are found in the areas between *C. kuesteriana* and *C. sabatoi*, including *C. zaragozae* Medellín, *C. hidae* Landry & Wilson, *C. microstrobila* Vovides & Rees, and *C. mexicana* var. *robusta* (Miquel) Dyer, species whose populations are well delimited. *Ceratozamia sabatoi* occurs amongst low shrubs in oak forests and mixed oak-pine forests on volcanic soils in relatively dry habitats; *C. kuesteriana*, however, is found in much wetter cloud-forests on karst topography.

The chromosome count and karyotype are consistent with that reported for the genus ($2n = 16$) by Marchant (1968), Vovides (1983; 1985) and Moretti (1990). The karyotype is nearly typical for the genus *Ceratozamia* (12m + 2sm + 2T), which appears to be stable. The msm and st chromosomes fall into these categories only by 0.03 and 0.01 μm respectively and, considering the considerable length of cycad chromosomes, these discrepancies are probably due to differential contraction at metaphase. The number and position of satellites varies between the species (Vovides, 1983). Two satellites have been reported by Vovides (1985) in *C. kuesteriana* and *C. sabatoi* has five.

Table 1. Karyotypic data at metaphase in root-tip mitoses of *Ceratozamia sabatoi* (mean of three metaphase cells). m = median, msm = median-submedian, sm = submedian, st = subterminal, T = terminal.

Chromosome pair	Arm length (μm) Long (L)	Short (S)	Total	Index (S/L)	*r* value	Centromere position
1	6.67	6.62	13.29	0.99	1.01	m
	6.92	6.10	13.02	0.88	1.13	m
2	6.78	6.15	12.93	0.91	1.10	m
	6.67	6.15	12.82	0.92	1.08	m
3	6.61	5.96	12.57	0.90	1.11	m
	5.67	5.30	10.97	0.93	1.07	m
4	5.53	5.41	10.94	0.98	1.02	m
	5.56	5.15	10.71	0.93	1.08	m
5	5.43	4.78	10.21	0.88	1.14	m
	5.54	4.18	9.72	0.75	1.33	msm
6	5.14	4.24	9.38	0.82	1.21	m
	4.92	4.15	9.07	0.84	1.19	m
7	5.14	1.96	7.10	0.38	2.62	sm
	4.99	1.66	6.65	0.33	3.01	st
8	6.64	0.00	6.64	0.00	0.00	T
	6.71	0.00	6.71	0.00	0.00	T

Symmetry index = 0.51. Average chromosome index = 0.72. Total chromosome length = 162.73.

Acknowledgments. We thank Ricardo Zirahuén, Christina Jocabeth P., and colleagues of the Comisión Federal de Electricidad (CFE) of the Zimapán Hydroelectric Project for permission, assistance, and use of helicopter in the field during the early exploration of the habitat. We thank CONACyT for partial funding of this investigation through project No. P020CCOR-904133. We also thank Edmundo Saavedra for the excellent botanical illustration of this species.

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